

UNIVERSITY OF TORONTO



3 1761 01282775 4

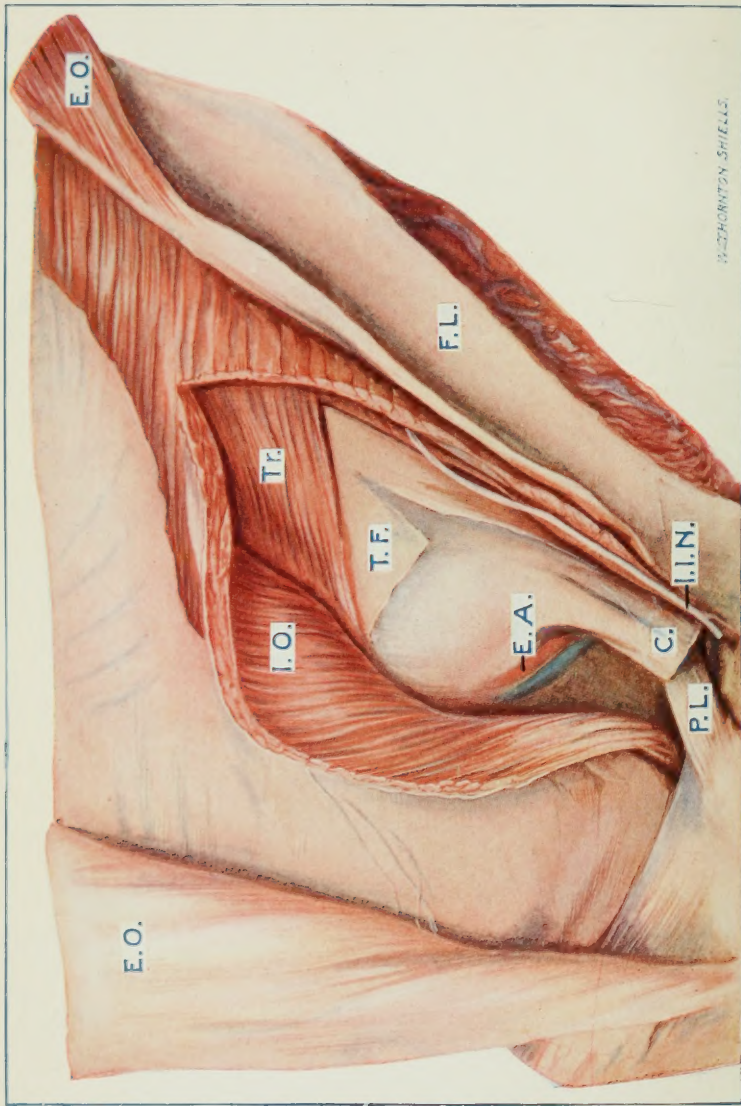
HERNIA

AND ITS RADICAL CURE

J. HUTCHINSON

OXFORD MEDICAL
PUBLICATIONS

HERNIA AND ITS RADICAL CURE



STRUCTURES CONCERNED IN THE RADICAL CURE OF INGUINAL HERNIA.

(From a Dissection in the Museum of the Royal College of Surgeons.)

E.O., External Oblique Aponeurosis divided and reflected on either side. I.O., Internal Oblique Muscle partially divided and raised. T.O., Transversalis Oblique Muscle. T.F., Transversalis Fascia partly reflected from the Inguinal Hernia which it invests. P.L., Poupart's Ligament. C., Spermatic Cord in its Fascial Sheath. E.A., Epigastric Artery. I.I.N., Ilio-Inguinal Nerve. F.L., Fascia Lata of Thigh.

THE OXFORD MEDICAL PUBLICATIONS

HERNIA

AND

ITS RADICAL CURE

BY

J. HUTCHINSON, F.R.C.S. ENG.

CONSULTING SURGEON, LONDON HOSPITAL; EXAMINER IN SURGERY, GLASGOW
UNIVERSITY; FORMERLY PROFESSOR AT AND EXAMINER IN SURGERY TO THE
ROYAL COLLEGE OF SURGEONS, LONDON.

209416
23 7 77

LONDON
HENRY FROWDE AND HODDER & STOUGHTON
THE *LANCET* BUILDING
1 & 2 BEDFORD STREET, STRAND, W.C.2

First printed 1923.

Printed in Great Britain by R. & R. CLARK, LIMITED, Edinburgh.

PREFACE

THE aim of this work is to provide a practical account of the various forms of hernia, with special reference to the best methods of obtaining its radical cure.

It will be found that some subjects, such as ventral hernia, the relation of the vermiform appendix to hernia, etc., are discussed for the first time with adequate fulness. On the other hand, such details of anatomy, differential diagnosis, and non-operative treatment of hernia, which are well given in every text-book, have been omitted. To describe all the varieties of trusses and their application would have greatly added to the size of the book, with little advantage. More and more of late years has surgical skill enabled patients with hernia to dispense with the irksome, and to some extent dangerous, employment of trusses.

It is indeed remarkable how greatly the improved methods of operating introduced during the last thirty years have altered the outlook and widened the range, since the time when surgeons of experience deliberately expressed pessimistic views when referring to "the so-called radical cure of hernia." The pioneer in this important branch of surgery was the late Professor John Wood of King's College Hospital, to whose original work all subsequent investigators of the field, both abroad and in England, have been indebted. From Professor Wood I learnt much when a student, and acquired a special

interest in the subject, which the experience of over a thousand operations on cases of hernia has only increased.

It may be that the frequency with which operations for radical cure of hernia are now performed has led to underestimating the difficulties that may be met with, and the necessity for careful selection of method and attention to details.

It is certainly a mistake to consider the operation as in any way a minor one. Success as regards final result—the real test—depends not merely on ordinary surgical skill or rapid performance. During the Great War abundant evidence came to light that some of the methods of radical cure in vogue left much to be desired. I am here referring to speedy recurrence of the hernia, and other complications, in young healthy adults. Again, those acquainted with the literature of the subject know that a great many proposed methods, or modifications, have been brought forward which are frankly inferior or valueless. I have endeavoured to pass these by unnoticed, or have given reasons why they should not be followed.

It is difficult, and perhaps undesirable, when selecting and describing methods of operating, to avoid the influence of one's own personal experience and choice. Nor is it possible always to do justice in assigning the true originator's name to some modification, but this is of minor importance.

References to, or quotations from, many valuable papers on the subject will be found in this book; but their number would have been increased had space allowed. For some illustrations, statistics, etc., I am specially indebted to the valuable treatise of M. Paul Berger contained in the *Traité de Chirurgie* published

by G. Masson of Paris. In the section on Anæsthesia in hernia operations my friend Dr. Austin Cooper has given me the results of his wide experience. The book throughout has been largely based on work performed at the London Hospital.

Improvements will continue to be devised in the treatment of hernia, and most certainly in another thirty years' time the methods will not be exactly the same as now.

But already the radical cure of hernia is one of the most successful of all operations, one of the most frequently performed, and one of the greatest importance to the community.

J. HUTCHINSON.

1 PARK CRESCENT,
PORTLAND PLACE, W.1.

CONTENTS

CHAPTER I

	PAGE
INCIDENCE AND CAUSATION OF HERNIA—THE HERNIAL SAC— FATTY HERNIA	1

CHAPTER II

INGUINAL HERNIA—ITS ANATOMY, PHYSICAL SIGNS, AND DIA- GNOSIS. THE OPERATION FOR RADICAL CURE, THE PRE- LIMINARY EXAMINATION AND SELECTION OF CASES. THE ANÆSTHETIC. THE MATERIAL FOR BURIED OR DEEP SUTURES	25
---	----

CHAPTER III

OPERATIONS FOR RADICAL CURE OF INGUINAL HERNIA—AFTER- TREATMENT—FINAL RESULTS AND OCCASIONAL COMPLICA- TIONS OF THE OPERATION	52
---	----

CHAPTER IV

CONGENITAL INGUINAL HERNIA. IMPERFECT DESCENT OF THE TESTIS. DIRECT INGUINAL HERNIA. INGUINAL HERNIA IN THE FEMALE.	89
---	----

CHAPTER V

INTERSTITIAL HERNIA. UMBILICAL HERNIA. VENTRAL HERNIA	113
---	-----

CHAPTER VI

FEMORAL HERNIA. OBTURATOR AND OTHER RARE FORMS OF HERNIA	143
---	-----

CHAPTER VII

	PAGE
HERNIA OF SPECIAL ORGANS—STOMACH, UTERINE APPENDAGES, VERMIFORM APPENDIX, BLADDER, ETC.	173

CHAPTER VIII

STRANGULATION: PATHOLOGY, SIGNS, AND SYMPTOMS . . .	202
---	-----

CHAPTER IX

STRANGULATED HERNIA: ITS TREATMENT AND RESULTS . . .	226
INDEX OF AUTHORS	259
INDEX OF SUBJECTS	261

ILLUSTRATIONS

PLATE I.—Structures concerned in the radical cure of inguinal hernia	<i>Frontispiece</i>
PLATE II.—Perineal testis	<i>To face p. 100</i>

FIG.	PAGE
1. Persistent congenital tube of peritoneum. (After Cloquet)	6
2. Multiple hernia and varicose veins in a subject with relaxed tissues. (Berger)	9
3. Two distinct hernial sacs lying side by side. (Demeaux)	10
4. An inguinal hernia, the sac of which bulges downwards into a hydrocele of the tunica vaginalis	11
5. Hydrocele of a femoral hernia, forming a large bilocular swelling in Scarpa's triangle.	14
6. An inguinal hernia containing small intestine	16
7. An inguinal hernia co-existing with a hydrocele of the cord	16
8. Sigmoid colon adherent to back of sac of a left inguinal hernia. (Scarpa)	17
9. Fatty hernia, simulating an omental one, and reaching down into the scrotum. (Original dissection)	21
10. Dissection of a large femoral "fatty hernia." Dissection and drawing by the author)	24
11. The external abdominal ring shown with the triangular fascia, the two pillars, intercolumnar fibres and the "weak area" above them. (Le Fort)	26
12. First stage of radical cure of inguinal hernia	55
13. Radical cure of indirect inguinal hernia	58
14. Figure-of-eight bandage of elastic webbing	60
15. Diagram showing method of twisting the sac and fixing it in a small aperture made through the muscular wall near the anterior superior spine	62
16. Radical cure of inguinal hernia	63

FIG.	PAGE
17. Radical cure of inguinal hernia. (Bassini's method)	69
18. Halsted's operation for inguinal hernia	73
19. Imperfect descent of the testis on left side	95
20. Testis retained in the inguinal canal, below which a large hernial sac descended into the scrotum	96
21. Partially descended testis with an inguinal hernia descend- ing to the bottom of the scrotum	96
22. Partially descended right testis with lax mesorchium and a large interstitial sac between the peritoneum and the muscles. (After Froriep)	114
23. Interstitial or interparietal hernia	117
24. True congenital umbilical hernia	119
25. Author's method of closing aperture in radical cure of um- bilical hernia	125
26. Transverse section of umbilical region after radical cure of hernia by double row of buried tendon sutures passed through aponeuroses	126
27. Barker's method of radical cure of umbilical hernia. (From Cheyne and Burghard)	128
28. Radical cure of umbilical or ventral hernia by method of overlapping	129
29. Radical cure of umbilical or ventral hernia by method of overlapping the aponeurotic edges.	130
30. Radical cure of ventral hernia, overlapping the aponeurosis edges by multiple sutures	141
31. Deep surface of the right inguino-crural region, from which the peritoneum has been removed. (Cloquet)	146
32. Bilocular sac of a femoral hernia, distended with fluid	147
33. An enormous femoral hernia which reached down to the knee. (Deroubaix)	149
34. Resected portion of ileum and of cæcum. (From Cheyne and Burghard's <i>Surgical Treatment</i>)	151
35. The left obturator foramen. (Poirier)	166
36. Right obturator hernia. (Brünner)	167
37. Dissection of a right inguinal hernia	181
38. Transverse section through the wall of an acutely congested vermiform appendix	183
39. Dissection of a right inguinal hernia. (Specimen in the museum of the Royal College of Surgeons)	185
40. The vermiform appendix with a lobulated ridge of fat	187

ILLUSTRATIONS

xiii

FIG.	PAGE
41. Normal vermiform appendix in early and late life. (Copied from Wölfler)	188
42. Band connecting vermiform appendix with the testis (arrested in descent). (From an original dissection in the London Hospital Museum)	193
43. Original dissection showing how a hernia of the vermiform process may occur in a pouch formed below the cæcum	194
44. Peritoneal fold or band connecting the vermiform appendix and cæcum above with the right ovary and Fallopian tube	195
45. Inguinal hernia. (Scarpa)	203
46. Partial enterocele (Richter's hernia). (After Scarpa).	209
47. Local infection with the <i>Bacillus coli</i> in strangulated hernia. (After Clado)	218
48. Infection of distant organs by the <i>Bacillus coli</i> derived from a strangulated hernia. (After Clado)	219
49. Right inguinal hernia with double sac. (Demeaux).	229
50. False reduction of a femoral hernia during operation. (After Farabeuf)	230
51. Clamps for gastro-intestinal operations	246
52. Makins's intestinal clamp	246

CHAPTER I

INCIDENCE AND CAUSATION OF HERNIA—THE HERNIAL SAC—FATTY HERNIA

REGARDING the prevalence of hernia in its different forms, a brief reference to statistics must suffice. It will incidentally bring out the importance of the subject.

When one speaks of hernia it is the inguinal variety that naturally occurs to one's mind, and this is explained by the following striking figures. Taking both sexes together, we find inguinal hernia by far the most common—73 per cent : femoral hernia comes next—18 per cent : umbilical about 8 : and all the other varieties only amount to 1 per cent. Considering only the male sex, inguinal hernia almost monopolises the field, being 96 per cent : whilst in girls and women the proportion is—inguinal 50, femoral 33, and umbilical 16 per cent.¹ But these figures leave out of account the important ventral hernia cases which are at least as frequent as the true umbilical ones.²

Of young recruits examined for compulsory military service abroad about 5 per cent (1 in every 20) are turned back on account of hernia—almost always inguinal. It is a curious fact that if a large number of old men be examined the percentage comes out much the same (6 per cent, *i.e.* 370 cases of hernia in 6400 examined). One

¹ These figures are from Dr. W. B. de Garmo's work on hernia : they agree in the main with those given by other writers.

² According to my figures obtained at the London Hospital relating to five recent years (1917 to 1921).

would of course have expected it to be much larger. Considering all ages and all kinds of hernia, it seems probable that five males are affected to every one female—in spite of the frequency of the femoral, umbilical, and ventral forms in the “weaker” sex.

It is difficult or impossible to estimate correctly the proportion of hernia cases to the total population, as they vary so much at different ages; suffice it to note that it is the most important malady that comes under the surgeon or that affects questions of labour and insurance, one of the most troublesome to its sufferers, and the most satisfactory to treat by operation. The operation of radical cure has undoubtedly prevented large numbers of men from becoming a burden on the taxpayer; it has also lowered the number of cases of strangulation during the last twenty years, and this happy result should steadily increase as the public becomes more and more informed in the matter.

But we can only expect this if the operation is known to obtain permanent success in a large proportion of cases. Great as has been the improvement in methods since radical cure was introduced, there is still much to be done in this direction. It may be noted that of the deaths from all causes 3 or 4 out of every 1000 (*i.e.* .35 per cent) are put down as due to strangulated hernia.

Statistics are dreary things to most readers, and I have therefore introduced as few as possible. As a relief, and turning from the numerical to the personal aspect, we may note that amongst the distinguished men who suffered from hernia were the great surgeon Sir Astley Cooper (who wrote a treatise on the subject), the composer Richard Wagner, and Edward Gibbon the historian. Cooper's book *On Hernia* was written before the era of radical cure; it would have been greatly improved had he deigned to refer more to the work of other surgeons and writers. Wagner's life was shortened by an inguinal hernia which had become irreducible and was attended by dyspepsia—though it may be questioned

how far the hardships he had undergone in Paris, and the dietary indiscretions he indulged in both in poverty and the reverse, were to blame for his abdominal symptoms during the last years of his life. Gibbon, who died at the early age of fifty-seven, had an enormous hydrocele and hernia (on the same side). He was ultimately persuaded to have the hydrocele tapped by Cline; he died suddenly after the operation.

NOTE ON HERNIA IN LOWER ANIMALS.—Among both dogs and horses hernia is not uncommon, inguinal, umbilical, or ventral in form, and in most cases it seems to interfere but little with their activity. Occasionally diaphragmatic hernia is seen in them. Amongst the smaller monkeys, if hernia depended solely on patency of the vaginal tube of peritoneum, we should expect a very great tendency to inguinal rupture, but *this is not the case*. Sir J. B. Sutton (with whom I worked at animal pathology at the Zoo some years ago) found only three undoubted cases of inguinal hernia in the bodies of 800 monkeys which he examined. These so-called "lower animals" also disprove the theory advanced by some writers that hernia has any relation to length or exact level of attachment of the mesentery.

THE CAUSES WHICH LEAD TO HERNIA

Heredity.—Hernia, like all forms of error in development, owes something to the influence of heredity. Malgaigne proved that in at least one in four cases of hernia there was a family history of similar trouble; Kingdon, Paul Berger, and others confirm this view. To explain it we may invoke in both father and son either (1) persistence of an open funicular process into adult periods, (2) defective development of abdominal muscles, (3) some occupation which favours hernia being followed by both, or (4) constipation or other factor in causing excessive abdominal strain.

Severe Abdominal Strain as a direct cause of hernia is shown in many ways. Violent attacks of coughing, whooping-cough in children, chronic bronchitis or asthma

in adults, the straining due to constipation, to a stricture of the urethra or an enlarged prostate, are all fertile causes of hernia.

Certain occupations in which the individual is in the habit of sitting with his body bent forward (*e.g.* tailors, weavers, bootmakers) favour the production of a hernia.

In boys phimosis has often been blamed as a cause of inguinal hernia, and its effect in this direction has certainly been over-estimated. However, in every operation for radical cure on boys or young adults, if phimosis is found to exist, it is best to perform circumcision at the same time.

In cases of neglected stricture of the urethra it is extraordinary how many herniæ may develop in the same individual: five or even more have been observed (Astley Cooper).

Frequently the onset of inguinal hernia in an adult is directly attributed to violent exertion during work, to a blow on the abdomen, to a fall, or the effort to save oneself from a fall. In such cases a sudden and excessive contraction of abdominal muscles occurs, together with abnormal position or movement which throws the strain and increases the tension within the lower part of the abdomen. The extent to which violent effort or trauma (it is indeed difficult to draw the line between these two) is concerned in producing inguinal hernia in adult men is brought out by the following figures:

Out of 243 cases of inguinal hernia developed during adult life the first onset was ascribed to

1. Lifting or carrying heavy weights, 103 cases—42 per cent.
2. A fall when carrying a burden, 17 cases—8 per cent.
3. Muscular strain or effort (*e.g.* in bicycling, gymnastics, etc.), 36 cases—15 per cent.
4. Blow or violent squeeze of the abdomen, 9 cases—3 per cent.
5. Coughing effort, 21 cases—9 per cent.

No cause was assigned and the hernia could fairly be called spontaneous in 57 cases—23 per cent.

We see that in no less than 68 per cent, or two-thirds of the cases, a violent effort or an injury such as may occur to any man engaged in hard manual work was apparently to blame for the onset of inguinal hernia. This fact is of great interest from the medico-legal point of view. How far can the development of a hernia in a man be ascribed to his work, and to what degree should his employer be held responsible for compensation to him either for the hernia or for complications happening to it?

Those extremists who claim the persistence of a congenital tube of peritoneum down the inguinal canal in every one of these cases will argue that the hernia was only partially the result of strain or trauma during work, and was therefore less a trouble acquired in the man's occupation than a defect of development. To my mind this extreme view is not only impossible of proof, it is quite unreasonable. That a local bulge of peritoneum at such weak spots as the inguinal fossæ can be produced by sudden increase of abdominal pressure is undoubted, and also that a small and insignificant protrusion will (as the cause is repeated again and again in the man's occupation) steadily grow to be a scrotal hernia of great size.

It is unnecessary to assume the pre-existence of a congenital pouch in most of these adult hernia cases, and to assert it in all is the extreme limit of dogmatic folly.

A practical deduction arises of much importance. There should be a thorough and efficient medical examination made of every man before admitting him to work in a factory, etc., and copies of the record kept both by the man and his employer.¹

¹ A committee of American Surgeons, Mr. W. B. Coley presiding, recently (*x. Amer. Annals of Surgery*, 1922) recorded their opinion that hernia is never due to injury or stress of occupation, and that consequently no man can be entitled to compensation on this ground. Mr. Russell, an Australian surgeon, has repeatedly asserted that every form of hernia is of congenital origin. My reasons for differing from these sweeping conclusions will be found in the text.

Thus many cases of hernia and varicose veins would be detected and if practicable submitted to radical cure, and many cases of imposture and erroneous claims for damages prevented.

Stress is laid upon the medical and surgical examination being thorough and efficient. During the years of

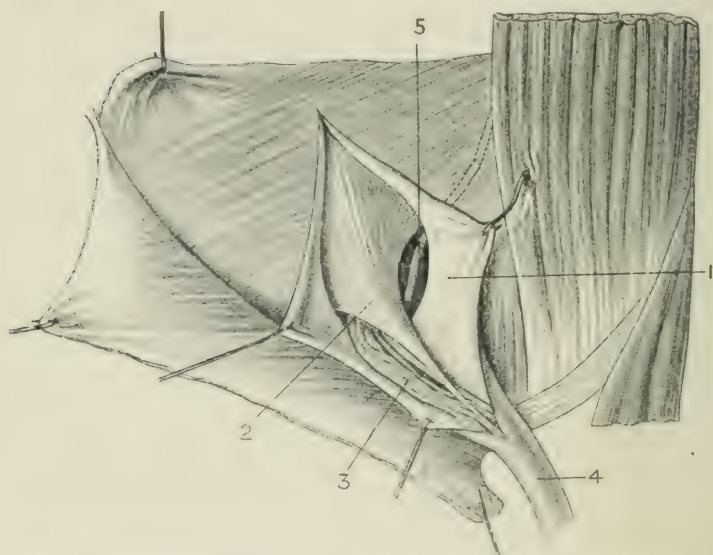


FIG. 1.—Persistent congenital tube of peritoneum (2), the remains of the funicular process, it tapers off into a fibrous cord lying in front of the spermatic vessels (3) within the cord (4). The muscles and transversalis fascia (1) have been dissected back; (5) the deep epigastric artery. In such a case a bubonocoele of very small size might be of congenital origin, but the subsequent extension into a scrotal hernia would be wholly *acquired*. (After Cloquet.)

the Great War (1914 and 1915 especially) hundreds of recruits were passed into the Army with overlooked herniæ, varicose veins, and other gross defects. They had, of course, all nominally gone through a “medical examination”!

Think for a moment of the trouble and expense produced by these overlooked herniæ, and the opportunity

afforded for fraudulent claims. It must be admitted that the detection of a small inguinal hernia is by no means always certain or easy. I have many times found one to be present on one day (perhaps very obvious) when previous examinations had entirely failed to detect it, in spite of all due exercises being tried. An empty tube of peritoneum can never be recognised by the surgeon's finger in the inguinal canal, and if the intestine or omentum cannot be induced to enter it when the patient strains, a negative opinion must be given—but for the time only if the least suspicion exists. Moreover, I am certain that in some cases a small hernial sac protrudes along the inguinal canal at one time and is retracted at others.

That one surgeon happens to detect a hernia in a case where another has previously failed to do so need not reflect the slightest discredit on the latter.

THE HERNIAL SAC

The diverticulum, or pouch of peritoneum which constitutes a hernial sac, originates in one of two ways—it is either preformed at birth or is gradually pushed or drawn outwards during later life at a weak spot in the abdominal wall.

The first, or congenital sac, is found in a large proportion of the cases of indirect inguinal hernia in both sexes, though by no means in all. It is believed that some cases of femoral hernia also owe their origin to a congenital protrusion of peritoneum (see p. 155), whilst most of the rare varieties of internal hernia (through the foramen of Winslow into the lesser sac, into the para-cæcal or duodeno-jejunal fossa, etc.) arise in the same way. There is a congenital form of umbilical hernia, of small importance compared with the acquired. It should be noted that an external hernia may originate in a small congenital sac which later increases in size and grows downwards (is pushed out by intra-abdominal pressure), so that a narrowing at the neck of the sac may become

displaced down into the scrotum. Hence in an adult the site of strangulation of an inguinal hernia may occasionally be found a considerable distance from the canal.

The second form of hernia, with a slowly developed sac *not of congenital origin*, is met with in practically all femoral herniæ, in many indirect inguinal herniæ in adults, in all cases of direct inguinal hernia, in most umbilical, in ventral, lumbar, and obturator herniæ, etc.

The distinction is of practical and not merely theoretic interest. As regards radical cure, the hernia with a congenital sac is, as a rule, more likely to give a permanent success after operation, which in itself is easier to perform than if the hernia were acquired. Contrast, for example, a congenital hernia in a boy with a ventral hernia in an adult or a large acquired umbilical or femoral protrusion. As regards ease of performance and certainty of success the difference between the two classes is most pronounced. Particularly unfavourable are those cases in which general laxity of the abdominal wall (coupled with some cause such as chronic bronchitis) has led to multiple herniæ in an elderly subject.

Congenital Origin of the Hernia.—That oblique inguinal hernia occurs in a large number of cases into a pre-existing tube or process of peritoneum has been known for at least a century, and of late years some writers have attempted to prove that all inguinal herniæ have this origin, *i.e.* they are congenital and none of them are truly acquired. This is a most exaggerated view. To give a few arguments only against it we may first note that other varieties of hernia are undoubtedly acquired; for example, all cases of direct inguinal, practically all cases of umbilical hernia in adults, almost all femoral. Again, the recurrence of an oblique inguinal hernia after the first sac has been excised can by no possibility be other than acquired, and it is sometimes seen in such recurrent cases that a large sac reaching into the scrotum has been formed by fresh protrusion of peritoneum.

Thirdly, the gradual pushing down of a sac, at first a mere bubonocoele, ultimately a large scrotal hernia, is an occurrence in adult life which every surgeon of experience must have met with.

I have myself seen during an operation a small process of peritoneum pushed into the inguinal canal during a strong expiratory effort of the patient, and again retracted or disappearing. It is quite unfair to claim the frequent

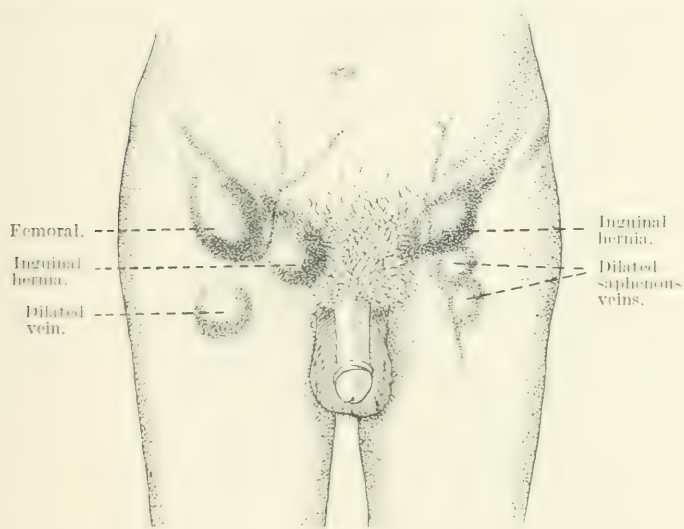


FIG. 2.—Multiple hernia and varicose veins in a subject with relaxed tissues. (Berger.)

presence of a small peritoneal depression at the internal ring as proof of the congenital origin of all inguinal herniae: such a depression is not a hernial sac, it is often acquired (and is met with at the femoral ring in many elderly subjects), and it should be interpreted as the first step towards an *acquired* hernia.

Finally, it may be mentioned that the gradual descent of the subperitoneal fat into the inguinal canal during adult life—drawing with it in some cases a peritoneal tube which may form a true hernia and not merely a

fatty one—is a good instance of how a rupture may arise apart from any congenital condition. This subject is treated later (see p. 18).

Avoiding “the falsehood of extremes” we admit that

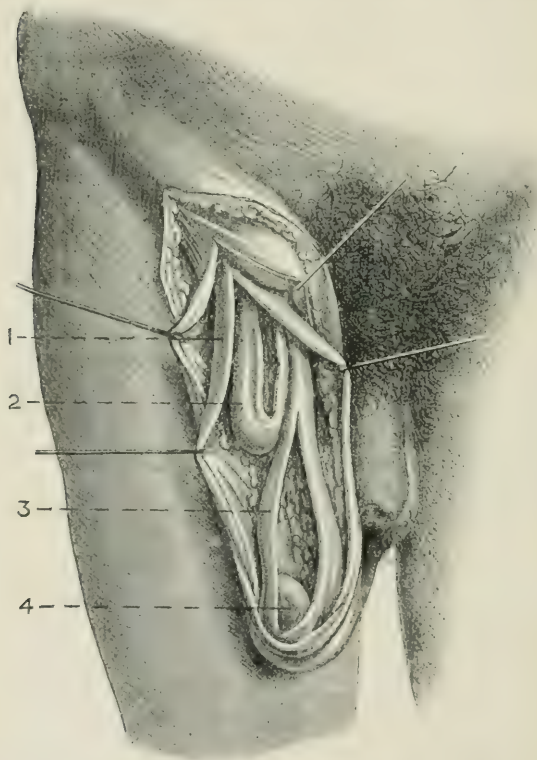


FIG. 3.—Two distinct hernial sacs lying side by side. (1) The cremasteric layer, (2) an acquired hernia reaching half-way into the scrotum; (3) a congenital hernial sac, with the testis (4) at its lower end. (Demeaux.)

oblique inguinal hernia, especially in boys and young adults, is often favoured by or directly due to the persistence of an open funicular process of peritoneum, and that occasionally this is true when the hernia develops first at a considerable age.

John Wood estimated that in exactly one-third of the cases of inguinal hernia on which he operated a congenital origin could be ascribed,¹ but if only adults are considered I believe the proportion is considerably less than this.

Certain peculiarities met with occasionally in the hernial sac owe their origin to developmental causes. A double sac, *i.e.* two distinct peritoneal tubes passing down

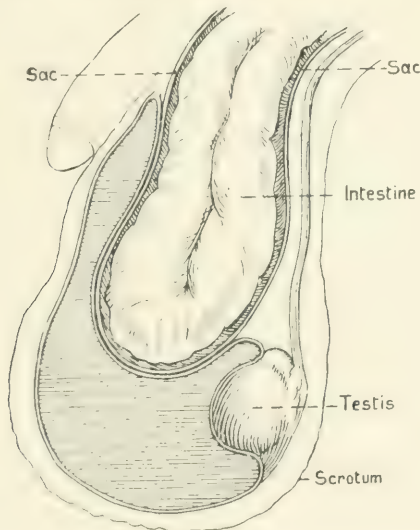


FIG. 4. — An inguinal hernia, the sac of which bulges downwards into a hydrocele of the tunica vaginalis.

towards the scrotum (a very rare condition which may greatly puzzle the operator), is probably to be explained, like the so-called "infantile hernia," by some fibres of the gubernaculum testis having drawn down an extra pouch besides the processus vaginalis.

Less easy is it to explain the rare cases in which a hernia depresses the upper wall of a hydrocele like a cup, or one sac bulges into another like an intussusception

¹ Professor John Wood's actual figures were 370 cases operated on, 123 apparently of congenital origin.

(of this Mr. Raymond Johnson placed a fine specimen in the University College Hospital Museum).

A constriction in the sac some way below the rings may be due to the original site where natural closure had begun being carried down lower as years went on, and the hernia increased in size. It will be convenient to discuss some of the above questions in connection with hernia and imperfect descent of the testis (p. 89).

Of course, as a general rule, a hernial sac in an adult is thick and is prone to be adherent to surrounding tissues and to the contents: whereas in a young subject it is more likely to be thin and non-adherent (except for the remains of the gubernaculum at its lower end).

But there are many exceptions. We know, for instance, how thin the sac of a ventral or umbilical hernia in an adult usually is, and sometimes in young boys with inguinal hernia a well-developed thick sac is found. The thickness and strength of the peritoneum certainly do not always correspond to those of the muscular wall outside it.

Reference is made elsewhere to most of the surprises with regard to the sac of a hernia which the operator may encounter on opening it.

To mention a few exceptional ones in my own experience. I have twice met with round, smooth, calcareous bodies free in the sac (like miniature billiard-balls, and doubtless derived from appendices epiploicæ).

In two cases of "strangulated" hernia fish-bones which had perforated the intestine were met with—in one of these the bone pinned the intestine to Gimbernát's ligament. In a third case the sac was full of castor-oil which had been injudiciously given before sending the patient to the hospital!

Tubercle scattered about the sac wall is not very rare in children, and the discovery that the hernia is, so to speak, peppered with small whitish nodules may be the first indication that tubercular peritonitis is present. In some cases tubercular epididymitis has infected a hernial

sac just above and adherent to it. The best course on making certain of this is to excise the testis and do a radical cure at the same operation.

The presence of cancer nodules in the sac wall has been met with now and again in umbilical, ventral, and inguinal herniæ, and, as in the case of tubercle, may first reveal the presence of the disease to the operator who has started out merely to do a radical cure of a hernia.

There are two other conditions of the sac which deserve more detailed consideration, namely hydrocele, and partial or complete absence.

Hydrocele of the Hernial Sac. -- A collection of fluid may form in a hernial sac, whether inguinal or femoral, owing to blocking of its neck by intestine or omentum, or to obliteration of the neck by operation, truss pressure, etc. Doubtless the fluid comes down from the abdomen in some cases, but it is certain that it may also be secreted through the sac wall just as in ordinary examples of vaginal hydrocele or hydrocele of the cord.

The simplest and most common form of hydrocele of the hernial sac is that in which a lump of omentum, not necessarily a large one, becomes adherent to the neck and plugs it like a cork. These cases are almost always met with in adults who have had hernia for long: the hydrocele steadily increases in size. In the inguinal region it may reach from the canal to the testis: in Scarpa's triangle it may extend for some distance down the thigh—as in one remarkable case under my observation, where it formed an hour-glass or bilobed swelling which extended from Poupart's ligament to six inches below. Unless very tense the tumour fluctuates, and translucency can usually be obtained in the inguinal variety, sometimes also in the femoral.

A certain amount of discomfort attends the swelling, owing to the tension. The amount of fluid may attain to half a pint, though usually less: it is clear amber in colour (possibly darker, though I have never heard of

a case in which the hydrocele became converted into a hæmatocele).

Several examples have been recorded in which a loop of adherent intestine became adherent to the sac neck and acted as a plug in the same way as the omentum, described above. These are of course more serious in their nature, as strangulation is more apt to occur.

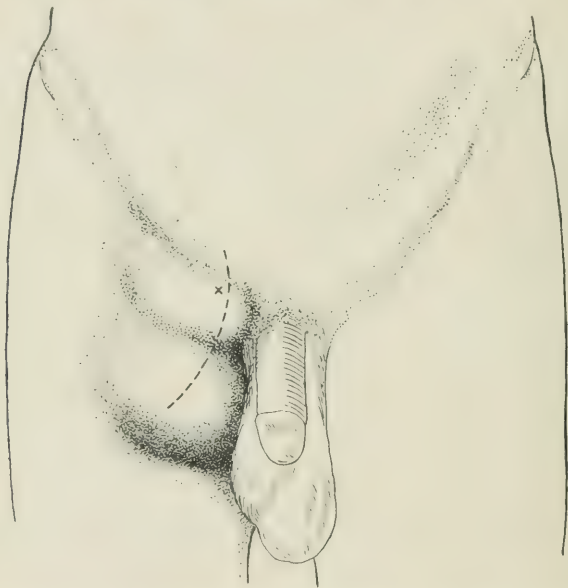


FIG. 5. Hydrocele of a femoral hernia, forming a large bilocular swelling in Scarpa's triangle. At the operation (the dotted line indicating the incision) the neck of the upper sac was found to be plugged by omentum.

It must not be supposed that hydrocele of the hernial sac is other than an exceptional occurrence, but it may give rise to difficulty or to errors in diagnosis, and in former days fatal results followed its treatment as a simple hydrocele by irritating injections, etc.¹

An interesting feature occasionally met with in

¹ Instances of this are described by Rizzoli and Curling.

hydrocele of the hernial sac is its change in size; for example, the omental plug may alter in position and so allow the fluid below to pass into the general peritoneal cavity. As a rule when once developed the hydrocele is permanent.

Plugging of the neck is not essential for its production, truss pressure may suffice. For example, a man wore a double inguinal truss for thirty-five years, and a very large hydrocele resulted in both hernial sacs below the truss (Curling).

In another example, due to truss pressure, not only was there hydrocele of the hernial sac but also one of the cord, and a third of the tunica vaginalis.¹

This leads us to notice the fact that after radical cure of inguinal hernia, especially when the canal has been narrowed too thoroughly, a hydrocele of the tunica vaginalis is apt to develop and may require a second operation. Of this complication I have, like other surgeons, seen a few examples, as well as several other cases in which the pressure of a truss has had the same effect in producing a hydrocele.

We know but little of the causes of ordinary hydrocele, but it is at least certain that undue pressure on the cord by obstructing the return of lymph and blood may lead to its formation as also to varicocele—a point always to be kept in mind when operating for radical cure of hernia.

It is also certain that if in operating on an inguinal hernia a considerable part of the sac is left behind in the scrotum there is a risk of this slowly secreting fluid and forming a hydrocele, with a consequent annoyance to the patient. Hence we should reject entirely the teaching of those who advise the "simple method" of a limited incision over the internal ring and putting a ligature round the neck of the sac, disregarding everything below this point. This method of course takes less time than properly dealing with the sac, but surely our object must

¹ Le Dran, *Observations on Surgery*, translation, p. 260.

be to perform a really efficient operation, and not to put the patient to the trouble of a second one, owing to our undue haste or neglect in the first place.

The coincidence of hernia with hydrocele of the cord of congenital origin is shown in Figs. 6 and 7.

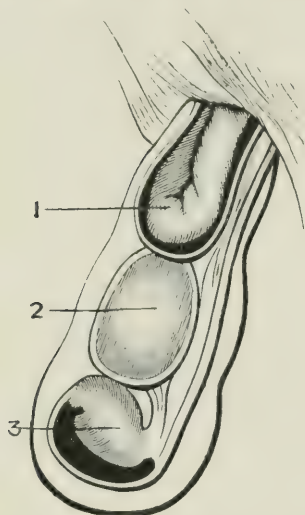


FIG. 6.—An inguinal hernia containing small intestine (1) lies immediately above a hydrocele of the cord (2). Below this is the testis (3) in its tunica vaginalis.

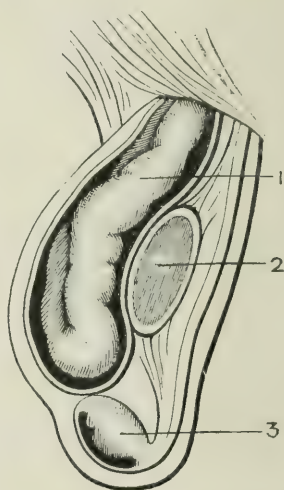


FIG. 7.—An inguinal hernia co-existing with a hydrocele of the cord. The hernial sac, containing a single loop of small intestine (1) passes down in front of the hydrocele (2), the latter has developed in an unobliterated portion of the funicular process. The lower end of the hernia rests on the testis (3).

Hernia without a Sac.—In so-called foetal umbilical hernia or ectopia of the viscera, a thin translucent membrane covers the protrusion, which is not really formed of peritoneum, and cannot be regarded as a true sac. In ventral hernia due to trauma, either accidental or operative, if the protrusion has occurred soon after the making of the parietal wound there will be no sac. When

the surgeon, in performing a hernia operation, has failed to secure the neck of the sac completely, a hernia may develop through the gap left. Ventral hernia, however, usually comes on some time after the operation, is due to yielding of the scar, and then, although the sac may be very thin and adherent to the contents, yet it exists. Hernia through the diaphragm has usually no sac.

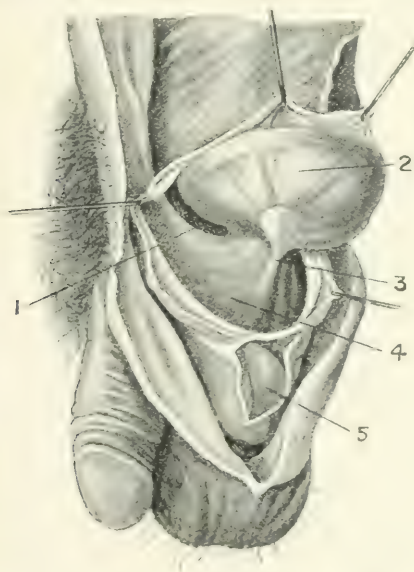


FIG. 8. Sigmoid colon adherent to back of sac (4) of a left inguinal hernia. The colon (2) has slid down with its mesentery (3). The neck of the sac (1) is large. The separate tunica vaginalis and testis (5) are seen below the sac. (Scarpa.)

A loop of bowel filling a sac may by inflammation become adherent all round, and so the sac ceases to exist: these cases are most difficult to operate on and attended with special danger of wounding the intestine. Fortunately *complete* obliteration of the sac by this means is very rare.

Most important of all are the herniæ of special organs, bladder, cæcum, and sigmoid, in which only a partial

sac exists. In these cases, occurring usually in adults, the viscus has steadily prolapsed into the hernial canal (aptly compared to a landslide), and the peritoneal covering may extend over only a portion of the organ. In dealing with such cases by operation the difficulty and danger are obvious, and the greatest caution is required in the use of the knife, nevertheless it is usually possible after patient dissection to return the prolapsed viscus within the abdomen sufficiently to enable a truss to be worn. (For further details see pp. 65 *et seq.*)

In discussing the descent of a hernial sac reference was made to the undoubted fact that a subperitoneal lipoma may precede it and thus a false hernia become ultimately a true one. This is the best place for further details.

FATTY HERNIA—SUBPERITONEAL LIPOMATA IN HERNIAL REGIONS

A condition which clinically resembles irreducible omental hernia is that named above. Even during operation the experienced surgeon may be completely puzzled as to which he is dealing with.

From other points of view the subject of "fatty hernia" in the groin is of much interest. Up till 1886, when I investigated and published an account of it in the *Path. Soc. Trans.*, few references to it had been made by English writers. This was curious, as Pelletan in 1780¹ had described fatty tumours in the inguinal and femoral canals, and both Sir Astley Cooper² and Mr. Curling³ brought forward cases.

Small fatty herniæ protruding through the abdominal wall, especially the linea alba, have been recognised for long. Their subjects are apt to be unduly sensitive

¹ Pelletan, *Clinique Chirurgicale*, vol. iii. In one of his three reported cases (inguinal) a large subperitoneal lipoma was said to be easily reducible. This is improbable; it may well have been omental.

² Sir Astley Cooper, *On Hernia, see Specimen in Museum of R.C.S., London.*

³ Curling, *On the Testis*, pp. 591 *et seq.*

and will commonly draw the surgeon's attention to what seems a very insignificant lump.

The ordinary large umbilical hernia of adult life is practically confined to stout or obese individuals: but this is by no means the case with fatty hernia, whether trans-parietal or occurring in the groin. The overgrowth of fat may be a purely local occurrence, thus the large femoral lipoma, see Fig. 10, which weighed 10 oz. was in a thin subject.

The "fatty hernia," whether it works through a gap in the abdominal aponeurosis (*e.g.* in the linea alba or one of the lineæ semilunares) or travels down the inguinal or femoral canal, is usually provided with a capsule which closely resembles peritoneum. Hence arise mistakes during the operation, though the capsule gives off septa between its contained lobules of fat. Moreover, a fatty hernia tends to draw down a tube of peritoneum into which intestine or omentum may protrude, thus what was originally a pseudo-hernia becomes a true one.

To consider first the *inguinal fatty hernia*, I have no doubt that most of the cases recorded as "lipoma of the cord" are really down-growths of subperitoneal fat.¹

It is admitted that fatty tumours rarely develop except where fat is normally present in considerable quantity. Thus Sir J. Paget states that "they are rarely, if ever, formed in parts at or near the trunk where very little fat naturally exists, as the eyelids and the greater part of the scrotum." Within the coverings of the spermatic cord there is, as a rule, extremely little fat. Thus out of twenty-two dissections I found it practically absent throughout the whole length of the cord in eleven cases, in six a few lobules were scattered around the vas and spermatic vessels, in four cases there were small outgrowths at the upper end (not large enough

¹ Curling relates eight cases of "lipoma of the spermatic cord," but does not suggest they had any connection with the subperitoneal fat, and Annandale in reporting similar cases expressly states they have not. The view, however, given above I am sure is correct.

to be detected during life) which had apparently come through the inguinal canal, and in one a similar protrusion was connected with the transversalis muscle.

I have dissected several examples of fatty hernia in which a considerable lump in the scrotum was connected along the inguinal canal with the fatty layer covering the peritoneum by a narrow neck, sometimes enclosing a small pouch of the serous layer. For some unknown reason the inguinal lipoma is most frequent on the left side: out of eighteen cases collected by the author, in thirteen this side alone was affected, in two both sides, and in only three the right side alone.

They are of course situated within all the coverings of the cord, perhaps wrapping round and concealing its normal constituents.

When the fatty hernia is first noticed its subject is usually elderly, forty to sixty years of age, though now and again the fatty hernia shows itself in early adult life. Often a truss has been ordered from a mistaken diagnosis, and considerable discomfort produced by this useless treatment. It is rare for the fatty hernia to be reducible, and there is not such a typical impulse felt on coughing as with intestine in a true hernia. But the impulse felt in a fatty hernia is just the same as in a true omental one: for this reason the practitioner first consulted is only too likely either to order a truss or to attempt reduction by taxis. By unavailing force employed in the latter, or perhaps by the truss pressure, hæmorrhages are produced, and what were innocent soft lobules of fat become hard tumours largely composed of organising blood-clot.¹

As shown in Fig. 9, the down-growth of subperitoneal fat along the spermatic cord may be for some time quite

¹ See case recorded by Sir H. T. Butlin (*Path. Trans.* vol. xxvi. p. 186), a pyriform mass of fat excised from the left labium majus of a woman; free hæmorrhage had occurred into it. In a case of the author's, a young man, a true inguinal hernia co-existed with a fatty hernia the size of a hen's egg which adhered to the sac below. This lump of fat was also full of blood, doubtless from taxis.

distinct from the vas and spermatic vessels, or at any rate easily separated from them by dissection. But when it has reached the scrotum it will probably have become intimately mixed, so that the surgeon in attempt-

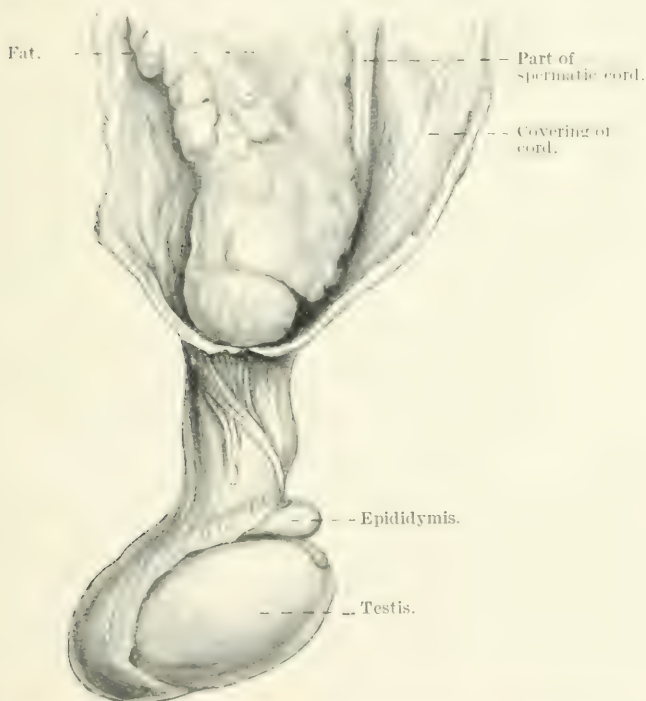


FIG. 9. Fatty hernia, simulating an omental one, and reaching down into the scrotum. The cremasteric and other coverings of the cord are partly dissected off the lipoma and held aside. Note that the lipoma, continuous above with the subperitoneal fatty layer, has no true sac. (Original dissection.)

ing removal has more than once been led to excise the testis as well.

The Diagnosis and Treatment of Inguinal Fatty Hernia.—So closely does it resemble in physical signs an irreducible omental hernia that one might be tempted to say the distinctive diagnosis is impossible, but this

would hardly be true. But it must depend on the delicate tactile sense of the surgeon's fingers, and not on any hard and fast rules to be given in print. As regards treatment it is most important to avoid the mistake of ordering a truss, and if the patient is sufficiently worried with his fatty hernia and there is nothing in his general health against operation, then excision of the fatty hernia should be performed. Here, as in all cases of true inguinal rupture, the value of laying open the inguinal canal is obvious; the neck of the lipoma can be separated from the cord most easily at its upper end and the dissection then carried out from above downwards; moreover, the peritoneal tube which is probably present can be detected best in the inguinal canal, ligatured high up, and removed.

The Recurrence of Inguinal Lipoma after Excision.—It is undoubtedly possible, though rare, for a fresh fatty hernia to form after apparently complete removal. There have also been many examples of this recurrence in the case of fatty tumours in the scrotal neighbourhood, when the subperitoneal origin was not certain. An extraordinary case was recorded by the famous surgeons, Sir Benjamin Brodie of St. George's, Lawrence of Bart's, and Curling of the London Hospital, in different scientific papers during the course of a quarter of a century.

A gentleman, aged 43, was treated for a left inguinal lipoma (diagnosed by several as a hernia). It steadily increased to the size of a melon (8 inches in diameter), and after many consultations it was excised by Travers and Lawrence. The fatty lobules so wrapped round cord and testicle that it was thought best to remove both with the lipoma. Four years later a recurrence in the stump of the cord—again wholly fatty in nature—was excised by Curling; during twenty-one years he had eight local excisions. On the last occasion the tumour adhered to the pubis, and had to be dissected out from beneath the pectineus. De Morgan and Hulke reported on this last recurrence as being partly sarcomatous in nature. The

patient, who was then sixty-four and in a weak state of health, died of chronic septic poisoning after the last operation.

It would be easy to dismiss this case, one of the most remarkable and puzzling in the pathology of tumours, as having been an example of fibro-sarcoma from the first, but this is quite impossible in view of the clear and detailed account of the original tumours, which were evidently a lipomata of subperitoneal origin. The question arises whether the irritation of repeated operation and formation of scar-tissue may not have led to the transition from an innocent fatty growth to a malignant sarcoma.¹

It should not be forgotten that the pubic and scrotal regions (the mons veneris of the male) are sometimes the special site of diffuse lipoma, next, perhaps, in frequency to the neck. These must be carefully distinguished from fatty herniæ. The exact symmetry, the saddle-like shape of the fatty lumps (median and lateral), the fact that the overgrowth is subcutaneous and covers the inguinal canals, are diagnostic signs of the diffuse lipoma.

Fatty Herniæ in the Femoral Region and Anterior Abdominal Wall.—A short notice must suffice for these, as some of the points have already been referred to.

A typical fatty hernia descending through the femoral canal is less common than in the inguinal region, though the sac of a femoral hernia is often surrounded with fat. In one remarkable case, from which I obtained the specimen by dissection, a large "hour-glass" lipoma protruded in front of the femoral vessels beneath Poupert's ligament like a "Cloquet's hernia." The upper half of the lipoma lifted up the peritoneum in the iliac fossa. During life the case had been regarded as an irreducible omental hernia (see Fig. 10).

The small fatty herniæ in the mid-line of the

¹ Few cases reported in English surgical works can have been associated with more distinguished surgeons' names. Brodie, Lawrence, Travers, Curling, Hulke, De Morgan, etc. The final report on it is given in the *Pathol. Trans.* vol. xviii. p. 186, and a general summary in Curling, *On the Testis*, pp. 559 to 563.

abdomen, often close to the umbilicus, more rarely in the linea semilunaris of either side, are well known. They

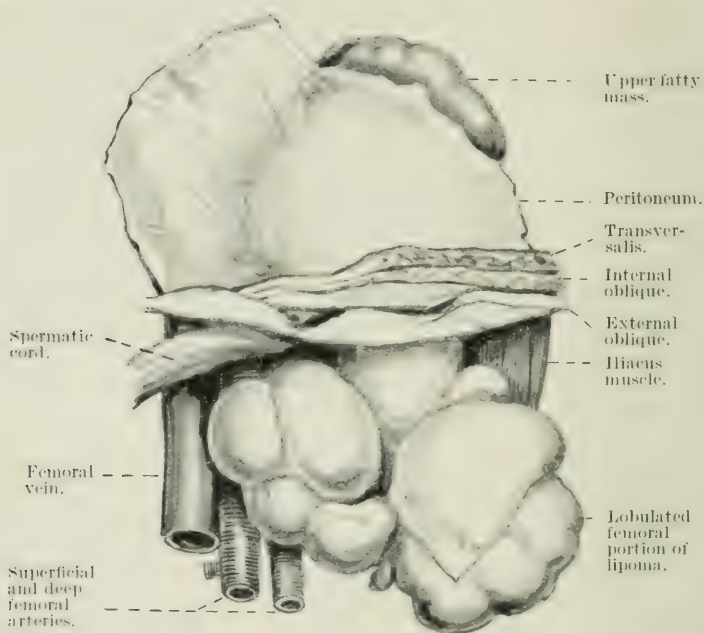


FIG. 10. Dissection of a large femoral "fatty hernia," the neck of which lay beneath Poupart's ligament to the outer side, and in front of the external iliac vessels. During the patient's life the lump was diagnosed as an omental hernia. (Dissection and drawing by the author.)

may draw out a tube of peritoneum, and their excision may be indicated owing to their causing discomfort, pain, or reflex symptoms.

CHAPTER II

INGUINAL HERNIA—ITS ANATOMY, PHYSICAL SIGNS, AND
DIAGNOSIS. THE OPERATION FOR RADICAL CURE. THE
PRELIMINARY EXAMINATION AND SELECTION OF CASES.
THE ANÆSTHETIC. THE MATERIAL FOR BURIED OR
DEEP SUTURES

ANATOMY OF INGUINAL HERNIA

The Structures forming the Inguinal Canal.—Fig. 11 shows the relative position of the two inguinal and the femoral apertures, the marked difference between the two pillars of the external ring, and the peculiar shape of the latter whose title, though short and convenient, has no more claim to accuracy than many other anatomical names. It is less a ring than an elliptical slit or elongated aperture, in the male adult 2·2·5 centimetres in length by 1·1·5 centimetres in width, its long axis placed obliquely upwards and outwards, its upper end being just above and to the inner side of the femoral ring, separated from it by the external pillar and Poupart's ligament, which blend together. This relation is noteworthy from the occasional difficulty that exists in the diagnosis of femoral from inguinal hernia, still more from the method of performing radical cure of femoral hernia by opening up the inguinal canal and sewing down the conjoined tendon to Poupart's ligament.¹

¹ Sir Astley Cooper's description of the normal dimensions of the male external ring agrees closely with those given above. From symphysis to intercolumnar arching fibres he gave 1 inch, transverse diameter of the ring $\frac{1}{2}$ inch, from the centre of the ring to the symphysis $1\frac{1}{4}$ inch. But the pubic spine is a better landmark for the external ring than the symphysis.

The arciform fibres limiting the external ring above vary greatly in development in different subjects, but whether strong or weak their edge can always be detected by the surgeon's finger invaginating the skin. Here it

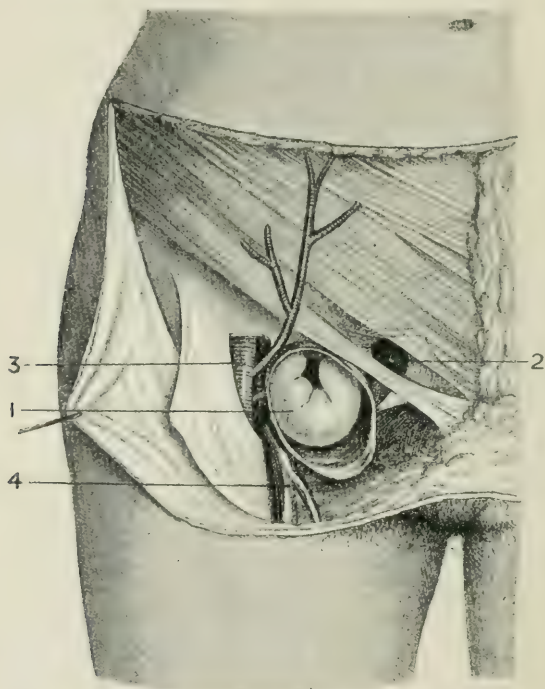


FIG. 11.—The external abdominal ring (2) shown with the triangular fascia, the two pillars, intercolumnar fibres and the "weak area" above them. The close relation of the inguinal canal to a femoral hernia (1) is also shown. (3) The common femoral artery giving off a superficial epigastric branch of unusual size. (4) The internal saphenous vein. (Le Fort.)

must be emphasised, that in the normal male adult the external ring *should just admit the tip of a normal index finger*, whilst one that has been long stretched by a large hernia may admit three or four.

An important practical deduction is that, in doing

radical cure, on no account should the external ring be narrowed by sutures to less than its normal size, or else there is sure to be trouble with regard to the circulation in the spermatic cord. Of course this does not apply to the few cases in which the cord is transplanted in front of the external oblique (Halsted's operation), in which the two pillars of the ring are sutured together as closely as practicable (at their lower end there must remain a small interval).

The external pillar, wide and comparatively thin above, narrows and thickens below towards its insertion into the pubic spine. The internal pillar is of more uniform width, shading off into the rest of the external oblique aponeurosis. Above the external ring we find, in most subjects, a weak part of the aponeurosis between the two pillars, strengthened it is true by the intercolumnar fibres which vary much in different individuals. It is through this "weak area" that the canal should be opened up in a radical cure operation, and the subsequent suturing if carefully done actually strengthens the anterior wall at this point.

In Fig. 11 behind the lower part of the external ring is seen the triangular fascia, reflected upwards from Gimbernat's ligament and the external pillar.¹ This fascia if well developed may possibly help to hinder the formation of a *direct* hernia, but it has no importance as regards the ordinary oblique form or the operation for its cure. On the other hand, the conjoined "tendon" (so called—it is really the lower muscular edge of the internal oblique and transversalis) is all-important when one seeks to brace up the inguinal canal, and is also utilised in one form of operation on femoral hernia.

Here I would emphasise the difference which exists

¹ Sir J. Bland-Sutton's view with regard to the internal pillar and the triangular fascia is of interest. He holds that the former is the homologue of the epipubic bone in the kangaroo, and that "Gimbernat's ligament and the triangular fascia are remnants of the very stout ligament which, in marsupials, anchors the epipubic bone firmly to the ilio-pectineal line" (Bland-Sutton, *The Nature of Ligaments*, etc.).

in individuals as regards the conjoined muscles. In most subjects the operator finds their lower edge fairly thick and well defined, suitable for drawing down and fixing to Poupart's ligament or to the external pillar. But in other patients, and not always those of poor general muscular development, we find a thin and ill-defined conjoined tendon, one which can be drawn down only with difficulty and undue tension on the sutures. The deduction is obvious—namely that the same method of strengthening the canal is not suitable for every case of radical cure. I am certain that where the conjoined tendon is thin, weak, or not readily to be drawn down, it is unwise to attempt Bassini's operation for inguinal hernia, still more so to endeavour to close the femoral ring by means of it.

In one remarkable case I found the conjoined muscles completely absent. The patient sought a radical cure for a double bubonocoele. On laying open the inguinal canal on one side, no trace of internal oblique or transversalis could be found. Exactly the same condition existed on the opposite side—it is to be presumed that the muscles were deficient throughout the abdominal wall. After dealing with the peritoneal pouches I did Halsted's operation on each side. The result was only moderate, as a tendency to bulge remained, and a light double truss was ordered.

I have never seen or heard of another case of this strange anomaly in development, though complete absence of the transversalis alone has been recorded (Macalister, quoted in Quain's *Anatomy*).

The lower border of the inguinal canal, formed chiefly by the blending of transversalis fascia with Poupart's ligament, makes a perfect bed or hollowed shelf for the cord to rest on. It is a strong argument for preferring method (1) of radical cure (see p. 58) to Bassini's or Halsted's method, that by it the cord remains in its natural bed, whilst both of the others involve displacing it.

Of the coverings of the cord the cremaster muscle and fascia form an invaluable guide during the operation,

the bundles of muscle being invariably easy to recognise. Beneath this one has only the infundibuliform fascia of varying thickness before one comes to the sac. Mr. Pringle of Glasgow, and one or two other surgeons, have brought forward plans for using flaps of the cremaster fascia to effect a radical cure.¹ The description and illustrations are difficult to follow, and not at all worth the trouble, as this fascia is quite unsuited for the purpose. The cremaster muscle should not be cut across in a hernia operation, separation of the bundles by blunt dissection is easy.

The remaining points in the anatomy of inguinal hernia are discussed in their appropriate place, or are too familiar to need recounting. It may, however, be noted that at the internal ring, lying in the subperitoneal layer, is a lymphatic gland, inflammation of which may give rise to mistakes in diagnosis. Its presence is less constant than the gland in the femoral canal.

The internal ring is normally situated $\frac{1}{2}$ inch above Poupart's ligament, midway between symphysis and anterior superior spine. It has a firm thick edge below and to the outer side, a weak one above and to the inner aspect. As regards the displacement of the internal ring which occurs in long-standing herniæ of adults, perfect illustrations of this occurrence, which practically does away with the canal and *almost* exactly resembles a direct hernia, are given in Quain's *Atlas of the Arteries*. It is discussed in the section on "Direct Hernia" (p. 105).

The ilio-inguinal nerve should not be forgotten, nor its situation just behind the internal pillar or border of aponeurosis (after opening up the canal). It is very easy for the operator to include it in one of his deep sutures, and it seems probable that this accounts now and again for pain *about* the scar of a radical cure.

Another point to be attended to in every operation on inguinal hernia towards its close is to ligature the small

¹ Pringle, *Brit. Med. Journal*, May 7, 1904; Halsted, *Johns Hopkins Bulletin*, August 1903.

vessels in the superficial fascia which have been divided and held in Wells' forceps early on. Of these the chief are the superficial epigastric artery and vein. M. Tillaux wrote that the operator need never trouble about this ("il ne mérite pas de préoccuper l'opérateur"). But neglect of these small and variable vessels—arteries and veins—crossing the area of the inguinal canal has sometimes caused trouble after an operation for radical cure. It is essential to secure them with Wells' forceps, and to ligature both cut ends before suturing up the wound. I have known a steadily increasing hæmatoma develop in the subcutaneous tissue and spread down to the scrotum. Mr. H. J. Waring¹ lays stress on the importance of ligaturing the "cut proximal ends of the superficial epigastric and superficial external pubic arteries" for fear of recurrent bleeding, and the necessity to open up the wound again. It is safer to tie both proximal *and distal* ends of these vessels, in fact this should be the operator's invariable rule.

PHYSICAL SIGNS AND DIAGNOSIS OF INGUINAL HERNIA

An inguinal hernia must be continuous above with the general abdominal cavity, its neck must be situated above, and to the inner side of the pubic spine, there must be an impulse on coughing felt either when the hernia is well down, or when it has gone back if the surgeon's finger is passed into the inguinal canal.

These signs (apart from strangulation which abolishes the impulse) are invariable.

Let us note: 1. The neck of an inguinal hernia if stretched, may completely overlap the pubic spine, and hence it happens (especially in a stout subject) that the detection of this landmark and the correct diagnosis between inguinal and femoral hernia may be very difficult. In such a case follow the adductor longus, made taut by

¹ *Operative Surgery*, p. 157.

abducting the thigh, up to its origin: or feel for the symphysis and trace the pubic crest out to the spine. Either method should succeed, then see if the hernial neck *can be displaced* towards the inner side of the spine—if so, the rupture must be inguinal, if not, it must be femoral.

2. Hernial impulse is of course most pronounced where intestine comes down, and is then so distinctive that it can be mistaken for nothing else, but if only omentum be present in the sac the impulse on coughing is always to be obtained on careful examination of the patient erect and supine. Even with the most resistant child who screams continuously during the examination patience will enable this sign to be detected.

Following the three cardinal signs given above come others less constant, but of considerable value. If an inguinal hernia contains intestine alone it is evenly distended, has a peculiar elasticity (like that felt on squeezing a partly deflated rubber bag), and on reduction the typical gurgling sensation is usually felt by the surgeon's fingers which steady the neck of the sac.

It is usually dull on percussion—unless the intestine is distended with gas alone, and is almost invariably opaque to transmitted light.

Omentum in the sac is, of course, also dull and opaque, is lobulated or “doughy” to palpation (see, however, the section on “Fatty Hernia,” p. 21), is reduced with much more difficulty than intestine, and is singularly apt to become adherent and therefore irreducible. Omentum by itself does not give the peculiar elastic feel when one examines the swelling with both hands—one over the fundus, the other at the neck—that is typical of intestine. Moreover, adherent omentum is apt to block the neck and so produce a “hydrocele of the hernial sac” (see p. 13).

Several writers lay down as a distinction between intestine and omentum in a hernia that the former is resonant to percussion, the latter dull. This is a complete fallacy as regards intestine, and it should be emphasised

that resonance or dulness in a hernia is of little or no value as regards diagnosis or treatment. In fact so easily may one be misled by trying this test, that it is better to ignore it and rely on other and far more certain signs.

There has been some controversy with regard to the possible translucency of a hernia. In adults (except for hydrocele of a hernial sac) the question does not arise, the hernia is always opaque. But occasionally in a child, one containing thin-walled intestine (empty, but distended with gas) may undoubtedly be translucent. This fact is noteworthy, as it might lead to the unfortunate error of tapping the hernia in the belief it is a hydrocele. Careful examination as to fluctuation should prevent this mistake, together with the observation that the hernia has no defined upper end, but merges into the abdomen. It should be noted that examination for translucency of a swelling is apt to be vitiated by the use of too strong a light and want of due care in other respects. Whenever reliance is to be placed on this test a wooden stethoscope or similar straight tube should be employed by the observer, the light should not be too powerful and should be placed immediately behind the part examined, everything else should be in darkness.

It is quite unnecessary to describe or illustrate the external appearances of the various forms of hernia—their local signs—but a few words must be said about

THE SYMPTOMS ATTENDING A HERNIA

Apart from strangulation of its contents, and apart from the local signs of a hernia, certain abdominal symptoms have to be considered. These are met with both at the very onset, when the local signs are hardly perceptible, and when the hernia is well developed. It is especially under the first-named conditions that mistakes in diagnosis are apt to occur. The patient complains perhaps of dyspepsia, of vague dragging pain

in the abdomen, of discomfort when taking exercise, perhaps of constipation, or of special aching on going to stool. Then local pain or tenderness in one groin may develop, and before long a definite bulge in the inguinal canal may be detected on careful examination by the surgeon. It is noteworthy that reflex abdominal symptoms especially occur in the case of small umbilical or fatty herniæ in the linea alba, etc. (see p. 18).

To turn to the other condition—where the hernia is well developed and cannot possibly be overlooked. Here, quite apart from strangulation, the patient is liable to abdominal discomfort and reflex disturbances which may greatly interfere with his or her general health. It is easy to see how adhesions of great omentum to a hernial sac may drag down the transverse colon and interfere with its proper peristalsis, constipation follows and probably increases the hernia—thus producing a vicious circle. In the same way the stomach may be displaced downwards. Whether from the latter cause or from interference with the small intestine it is common for the patient to be dyspeptic, to suffer from eructations or “biliousness,” to become generally depressed. In following up a long series of cases, cured by operation on their herniæ, nothing is more gratifying than to note the improvement in general health that has resulted in a large proportion from the removal of their local trouble.

I have found this hold true with all varieties of hernia in adults, patients have expressed their surprise at the gain in vigour and well-being which ultimately resulted from the operation.

Here a seeming paradox has to be recorded—a small hernia may cause much reflex trouble, a very large one may be attended with practically none. I have seen a patient with an enormous inguinal hernia hanging half-way down his thighs, irreducible and containing a large proportion of what should normally lie within his abdomen: yet this man hardly admitted it was any inconvenience to him!

Another point has struck many observers, that the discomfort and danger of a hernia vary with the season of the year. It is in the winter months, when abdominal chills, bronchial catarrh, and similar troubles prevail that the patient is likely to find his hernia increase in size, to cause greater discomfort, or finally to become strangulated.

M. Berger¹ calls attention to the fact that during pregnancy the functional troubles due to a hernia are apt to cease, and he ascribes it to the enlarging uterus preventing the descent of intestine; but at the same time strangulation in a hernia during pregnancy is by no means unknown.

The various kinds of truss suitable for different cases, the methods of measuring and fitting them, the degree of tolerance shown for them, and other matters connected with non-operative treatment of hernia, form a large subject which can only be referred to incidentally in this book. There are good monographs on it by Dr. W. B. de Garmo, Professor John Wood, and other writers.

It may be noted that the only form of hernia in which a permanent cure can be expected from long-continued use of a truss is the congenital inguinal variety in a child or young adult, and that even here failure is not infrequent.

We pass now to the operation for radical cure, with especial reference to inguinal hernia.

PRECAUTIONS BEFORE OPERATION

Preliminary Examination of the Patient.—With regard to this, in the rush of hospital work, an important rule is sometimes broken—it is this: In every case before undertaking a radical cure of hernia, *the operator should himself examine the patient.* Of course in private practice he is certain to do so, but how many mistakes have occurred and how much discredit has arisen from neglect of this

¹ Berger in Duplay and Réclus, *Traité de chirurgie*, vol. vi. p. 572.

simple rule ! Cases have occurred where the patient has been anaesthetised, and the operator, who has not previously examined him, finds that the side of the hernia has been wrongly stated or not given at all by his colleague in the Out-patient Department. Or a double hernia really exists, the operation is limited to one side, and later on the patient has to undergo the ordeal of a second one. It is obviously necessary that the surgeon should previously examine *both sides*, and should also ascertain if any complication of the hernia exists—such as a varicocele for instance. During the operation it is easy to deal with the varicocele as well as the hernia, but unless the existence of the former has been noted before the patient comes on the operating-table, it will not be found out as he lies recumbent. Phimosis in a boy with hernia should invariably be noted and dealt with by circumcision at the time of the major operation.

The operator should satisfy himself as to the existence and nature of the hernia, for it has often occurred that a case of femoral hernia has been admitted to the ward as inguinal, and *vice versa*. Then comes the important question whether any bar to operation exists, either local or general. A pendulous lower abdomen, the existence of several distinct herniæ, a very fat or very relaxed abdominal wall—each of these conditions will probably negative the idea of operation.

Supposing that as regards the hernia itself no contra-indication to operation is found, the general health of the patient must be gone into before accepting the responsibility of doing a radical cure.

The urine must be tested, chronic bronchitis or phthisis excluded by examination of the chest—which will also satisfy the surgeon as to the condition of the heart. Chronic alcoholism or the history of recent addiction to strong drink has to be sought for; I have personally had to reject many patients on these grounds—at any rate have had to defer operation until they had abstained for a sufficient time. In young children, as in adults,

the existence of bronchial catarrh should lead to the operation being deferred until the patient is perfectly well. It should be remembered that the anæsthetic will almost certainly aggravate any chest trouble, and may induce it, and thus the success of the operation be imperilled. To some extent this is an argument in favour of using stovaine instead of ether, etc., and the intra-spinal method has been employed on a large scale for hernia operations, both on children and adults. The question of the special risks of stovaine will be dealt with elsewhere (see p. 43).

Even if all the precautions mentioned above have been taken, it is still difficult to exclude certain rare contra-indications to the operation such as hæmophilia. But the risk of this being present without any previous indication is exceedingly small.

A young man, aged 20, had worn a truss for two years for an inguinal hernia, it became irreducible, and radical cure was naturally indicated. Neither he nor his relations said anything to make one suspect he was a bleeder, and I did not therefore hesitate to operate. The wound itself did perfectly well, but soon after the operation he had definite signs of internal hæmorrhage, including causeless hæmaturia. On inquiry we found a history of hæmophilia. Fortunately he ultimately recovered. If the facts had been known before operation I suppose it would not have been performed.

The Age of the Patient.—Provided all other conditions are favourable an age limit need hardly be fixed. One of the oldest patients on whom I have performed radical cure was a man aged 70 years, who had for long been troubled with a double inguinal rupture. Both sides were operated on at the same time, and the patient made an excellent recovery. In the event of strangulation of a hernia, a complete operation, including the radical cure, may happen to be required at an even greater age than this, ninety years or later!

In a woman, aged 86, a femoral hernia had been

threatened with strangulation, it was irreducible, and I decided to do a radical cure, which was uncomplicated, and proved a complete success.

Lucas-Championnière, a Paris surgeon, who was acknowledged to be one of the chief authorities on the radical cure of hernia, laid down the axiom that between seven and forty years was the proper age for operation. The chief inference from this would be that many cases under the age of seven can be cured by truss treatment, but of later years the tendency has been more and more to resort to operation in infants and young children, provided the parents will consent. As noted above, there is no reason whatever to limit the operation age to forty, and the bulk of the hernia (if long irreducible) is much more important to consider than the mere age of the patient. In the case of a very large hernia, probably containing much of the small intestine (and even a good deal of the large, *e.g.* cæcum, sigmoid, or transverse colon) the most formidable difficulty may be met with in getting back the contents of the sac into the abdomen again. Fatal results have occurred from this cause alone.

Again the presence of several herniæ in the same patient requires investigation and treatment of their cause rather than premature resort to operation.

The last point to be considered relates to the advisability of *operating on cases of recurrent hernia*. There is a variety of hernia in which the surgeon should hesitate before undertaking an operation—namely, when recurrence has followed a first attempt at radical cure, especially when the condition of the scar or the history proves that suppuration had followed this first operation. The question arises chiefly in the inguinal region, and probably the first operation has been done elsewhere and the method used is not known. Under these circumstances a second attempt at radical cure may prove very difficult, to some extent dangerous, and may again prove unsuccessful.

Of course there are many exceptions, but a safe rule

is that where a suitable truss is effective in retaining a recurrent hernia it is best not to operate again. The points just mentioned cannot be brought out more strongly than by quoting from a report of eleven cases of recurrent inguinal hernia, operated on at St. Thomas's Hospital in 1896. All the patients were under fifty years of age, and most of them were young men. In three cases slight suppuration was said to have occurred after the original operation, but after the second it followed in no less than seven. *Two of these patients died of septic peritonitis.* It is possible that the use of silk or gold-beaters' skin for the deep ligatures was in part responsible: and in one a ligature had been placed on the omental stump close to the colon ("which was possibly wounded"). Still, a proportion of suppuration in 70 per cent and death in 20 per cent after simple radical cure of inguinal hernia is unheard of in cases of primary operation.

It is thus obvious that rapid and sound healing of the wound is essential, and where the conditions are such that this is problematical the surgeon may well hesitate to operate.

With regard to recurrent femoral or umbilical hernia there is less reason to avoid a second operation where it seems to be required, and like most surgeons I have occasionally had to do this for recurrence in the inguinal region with fair success.

Briefly the advice to a patient with hernia as to operation will be based on the following:

Selection of Cases for Radical Cure.—1. In children with inguinal hernia of moderate size and easily kept up by use of a truss, operation may often be dispensed with. If, however, the truss is not well tolerated, or does not succeed in keeping the rupture up, there need be no delay in resorting to operation. As a general rule it is best to wait until the child is two or three years old, but there are many exceptions.¹

¹ Cure by truss pressure in young infants demands considerable

2. In young adults the presence of a well-marked hernia, one reaching to or beyond the external ring, is a clear indication for radical cure. In such cases the use of a truss even for some years is rarely followed by obliteration of the peritoneal canal.

3. As regards operation after forty years of age each case must be decided on its merits, and to some extent by the patient's occupation. In some pursuits the wearing of a truss is almost impossible, in others it causes only slight inconvenience. No age limit can be laid down, and excellent results are obtained from operation for radical cure on patients over fifty years old.

In elderly subjects chronic bronchitis is the chief contra-indication to operation, since the lung symptoms will be increased by the anæsthetic, and may have a serious effect upon the healing of the wound. Very stout patients, and still more those who are thin, feeble, and elderly, should be rejected. Evidence of severe visceral disease, either of kidneys, heart, lungs, or liver, is an absolute bar except where strangulation of the hernia occurs.

Any case in which the sac has long contained much irreducible intestine is not favourable for radical cure; still even under these conditions the attempt may be justified by the result.

In the case of a double hernia—inguinal on both sides (this is fairly frequent), inguinal and femoral, etc., both herniæ should, as a rule, be operated on at the same time. The presence of several incomplete herniæ or weak spots in the abdominal wall should, however, be regarded as a direct contra-indication.

expense and infinite care. If after two years' constant use of the truss the hernia still comes down, operation will certainly be required. In any case it is important to cure the hernia before the boy is sent to school.

THE ANÆSTHETICS EMPLOYED IN HERNIA
OPERATIONS

There is considerable variety of choice in this matter, and a good deal may turn on the proper selection being made. It is important during the operation that the patient's muscles should be perfectly relaxed, and that after it straining and vomiting should be avoided as far as possible. After operations for strangulated hernia, and after certain prolonged "radical cures," lung complications—such as bronchial and pulmonary congestion or even pneumonia—have sometimes proved troublesome or fatal. It is difficult to say in these how far the anæsthetic in itself has been to blame. If a case of strangulation has proved fatal after operation, some degree of pulmonary œdema or inflammation is almost invariably found post-mortem. This may have come on only as the patient was moribund and the heart and lung centres were steadily failing, or, on the other hand, it may be due to infection with the bacillus coli which swarmed in the hernia itself, in the fluid in the sac, etc., and was circulating in the blood. The presence of this bacillus in the lungs under these circumstances has been proved again and again. Apart from these grave conditions, and considering only the operations for radical cure on healthy subjects, it is obvious that post-anæsthetic vomiting or struggling may throw undue strain on the deep sutures and perhaps lead to failure.

1. The only form of anæsthetic which is entirely free from this drawback is the local injection of novocain or some similar drug. Novocain is far less dangerous than cocaine: as much as 10 grains (.6 gramme) MAY be injected in an adult, though less is advised. The efficiency of the solution is increased by the addition of adrenalin (1 part in 1000). Various strengths are used, of which the following may be taken as an example :

Novocain, 1 grain.

Adrenalin solution (1 in 1000), 1 minim.

Normal saline solution, 1 ounce.

Three to six ounces of this solution, sterilised by boiling, may be injected into the tissues around the hernia during the operation. Much of it will, of course, escape as this proceeds. In inguinal hernia special attention is paid to injecting it along the ilio-inguinal nerve within the canal, but, generally speaking, it is impracticable to seek any special nerves: one simply injects through the skin into the superficial fascia, and after making the incision endeavours to infiltrate the neighbourhood of the sac.

Local anæsthesia, it may at once be emphatically laid down, is not well adapted for hernia operations, and it must be quite exceptional for the surgeon to have to resort to it.

The following objections to it exist:

- (a) Except in small herniæ, *e.g.* some femoral ones, it is most difficult to infiltrate all the tissues round the sac.
- (b) The necessary manipulation, traction, and ligature of sac and omentum, etc., cannot be rendered painless.
- (c) The operator is hampered by the swollen, oedematous condition of the tissues from his injection.
- (d) There is risk of poisoning from absorption of the drug.
- (e) An involuntary movement on the patient's part from fear or pain at a critical moment of the operation may cause grave trouble.
- (f) It takes considerable time—twenty to thirty minutes—for the injection to act well.
- (g) If unforeseen complications arise the operator will be handicapped by his knowledge that the patient is still conscious and suspects the operator to be in difficulties!

Finally, it may be noted that if special circumstances exist which lead or compel the surgeon to resort to local

anæsthesia for a hernia case, he will be much helped by giving a preliminary injection of morphia, or morphia and atropine. He should have ether at hand in case the local anæsthesia is insufficient. Ether is said to be an antidote to the toxic effects of novocain, etc.

2. On the use of stovaine (spinal analgesia) in hernia operations it would have been necessary, but a few years ago, to write at length. As a result of the able advocacy of Professors Bier and A. E. Barker, this method came into very wide use, especially when a first-rate anæsthetist was not available. As regards providing facilities for the operation, it is free from nearly all the objections already mentioned with regard to local anæsthesia. The parts are not swollen by artificial œdema, but are in their natural state; the abdominal muscles are relaxed; the sac and omentum can be handled, as a rule, without pain under intraspinal injection carried out efficiently. Novocain, tropacocaine, and stovaine all have been largely employed, but the use of any, unfortunately, is liable to be followed by serious results. Indeed one American writer ascribed a mortality of at least 1 in 200 directly to their use. Professor Barker's personal statistics were, however, not nearly so unfavourable as this.

Intraspinal analgesia was welcomed with enthusiasm by many surgeons for hernia as for other operations in the lower abdominal region, and it is still practised. Although in 5 to 10 per cent of the cases the anæsthesia will not be perfect, in the great majority there are anæsthesia, analgesia, and relaxation of muscles.

Tropacocaine (5 per cent solution in normal saline) may be used—up to about 1 grain of the drug. Stovaine (also in 5 per cent solution, with the same amount of glucose as stovaine) is more frequently employed.

It would take too much space to describe here the technique of intrathecal injection, and the omission matters less, as it is the writer's opinion that this method of obtaining anæsthesia should very rarely be employed in hernia operations. Its direct mortality is higher than

that following general anæsthesia in skilled hands, it sometimes fails in obtaining proper relaxation of muscles and freedom from pain during the operation, but above all it is apt to be followed by special untoward results. Of these (1) nausea and vomiting, (2) cardiac and respiratory depression, (3) rise of temperature for a few days, (4) headache and nervous depression, (5) incontinence of fæces or urine or of both, (6) oculo-motor paralysis, and (7) paraplegia have to be noted. The writer has heard of several cases in which permanent damage has resulted to the patient from intrathecal injection of stovaine, and it is a fact that at one of the largest hospitals in Great Britain the House Committee prohibited its use for a considerable time on account of the numerous accidents that had occurred.

3. We have seen the drawbacks to the use of either local anæsthetics or spinal analgesia in hernia operations: fortunately those which, to some extent, attended general anæsthesia have been removed by improvements in technique.

Of the latter the chief are preliminary injection (one hour before operation) of morphia and atropine, or of atropine alone in the case of adults in whom excessive bronchial secretion is to be feared; the use of nitrous oxide gas and oxygen for the initial stage of anæsthesia; the substitution of ether for chloroform and chloroform mixtures; and the abandonment of the closed bag inhalers in favour of the open method of ether administration.

The bag inhalers, however ingenious, cannot be sterilised: with them the patient inhales carbonic acid gas as well as the anæsthetic, and without doubt some pulmonary complications are occasionally due to their use.

There are a few cases of hernia, and very few, in which the anæsthetist prefers to use chloroform or C_2E_2 throughout instead of ether, but it has been proved so conclusively that the open-ether method is the safest at practically

all ages that we urge its use as a routine during hernia operations.

The credit of introducing the simple and very safe method of giving ether drop by drop on an "open inhaler" is, I think, generally claimed as an American invention. This is not the fact. For many years before it came into use in the United States my father, Sir Jonathan Hutchinson, practised and taught its advantages. In various publications he urged its comparative safety and its simplicity. In several branches of medical and surgical science my father made valuable additions which are not forgotten, but the fact that he was the pioneer in "open-ether" administration is probably unknown to most.

Dr. Austin Cooper has kindly given the conclusions he has drawn from his very wide experience of giving anæsthetics during hernia operations. He writes: "I am quite in agreement with you as to the use of open ether in the large majority of cases—there is no safer or better anæsthetic; even small children take it well, but in their case ACE given on a Rendle's mask perhaps produces a nicer anæsthesia. I always precede open ether by either CE₂ or ACE until the excitement stage is passing off, when I revert to plain open ether dropped on gauze (six or eight) layers placed on a Schimmelbusch mask. This is very much pleasanter for the patient, is quieter, and much less irritating than the initial inhalation of plain ether.

"This method should always be preceded by a hypodermic injection of atropine, $\frac{1}{100}$ gr. for an adult, and $\frac{1}{200}$ for children (I find at St. Thomas's they now give $\frac{1}{60}$ to adults, but I think $\frac{1}{100}$ answers all purposes). The injection should be given half an hour beforehand, and may be combined with either morphine or scopolamine, as circumstances seem to demand, *e.g.* in very nervous people a little morphine has a wonderfully soothing effect.

"I am quite sure the use of atropine lessens the tendency to bronchial trouble.

" I do not think that there are the same objections to ether, as given at the present day by the open method, as formerly when the closed method only was used, and atropine seldom if ever given. Also I am sure the practice of rebreathing from a rubber bag must have been the cause of infection in many cases.

" Personally, I am not a lover of stovaine, although it has its uses: it gives beautiful relaxation, which is invaluable in some of the cases of large umbilical herniæ, when the abdominal cavity seems incapable of accommodating anything more. It may also be used with success in cases of strangulated hernia occurring in very debilitated and bronchitic subjects, and if desired may be combined with gas and oxygen, or a little ClE_2 and ACE, to produce unconsciousness.

" I make it my usual practice to give strychnine hypodermically immediately after the stovaine, $\frac{1}{320}$ or $\frac{1}{640}$ according to the physique of the patient, but generally the former dose.

" Before following this routine I have spent many an anxious time, but have never had a fatality myself. I have personally had no experience of this drug in children, and have no desire to use it. I believe it has been used at Gt. Ormond Street.

" I have a great objection to the practice of injecting toxic drugs into the body unless we have some means of ascertaining beforehand the susceptibility of the patient to that particular drug, which often means too little or too much, whereas by the older and tried methods of inhalation anæsthesia we have the power of increasing, eliminating, or withholding the anæsthetic as occasion demands.

" The stovaine we use at the London Hospital is prepared by Billon of Paris, and is put up in ampoules of 1 c.c. containing 10 centigrams, $\frac{6}{10}$ to $\frac{7}{10}$ being the average dose."

THE MATERIAL TO BE USED FOR THE BURIED
SUTURES

In hernia operations it is necessary to employ buried sutures, and in some forms of hernia, *e.g.* ventral and umbilical, to use a considerable number and to rely upon their persistence for the cure. In nearly every case of inguinal and femoral hernia the operator will make use of *some* buried sutures, and what material is the best for the purpose becomes an important question. As a rule it is inadequately treated by writers on the subject of hernia.

We require sutures which are at the same time strong, not soon absorbed, and yet non-irritating to the tissues.

1. In my opinion there is no material which answers these requirements so fully and so well as kangaroo tendon.¹ In closing a large hernial aperture it may be desirable to use sutures of considerable thickness; in other cases this is not necessary. As may readily be proved, the tendon sutures are very strong, perfectly supple, and if all aseptic precautions are observed they become organised into fibrous tissue, blending with the tendinous structures, etc., in which they have been inserted. It is a common delusion, responsible partly for their comparative neglect in surgical practice, that tendon sutures are absorbed after a short time, in the same way as catgut. During thirty years' operative experience I have employed kangaroo tendon for buried sutures in many thousands of cases, and have very rarely known them to irritate or work out. When they have done so some failure in technique has doubtless been the cause,

¹ The tendons are obtained from the tails of the smaller kangaroo or wallaby, of which animal there is an unlimited supply in Australia. There is no reason, apart from profiteering, why they should be expensive, and they can be preserved an unlimited time in alcohol charged with a suitable antiseptic such as corrosive sublimate or carbolic acid. Of course they do not stand boiling, and immediately before use they should be placed in sterile and cool water so as to remove their preservative.

or else they have been inserted in a case in which suppuration was almost inevitable (*e.g.* removal of gangrenous appendix, etc.). Even then the tendon sutures have usually served their purpose before being disintegrated and thrown off. I doubt if they are ever responsible for such tedious suppuration, such long-standing sinuses as are matters, unfortunately, of common experience when thick silk has been buried and has been resented by the tissues.

As to the persistence of kangaroo tendon, I have now and then had the opportunity of examining sutures I had inserted two years or more previously. They were still to be recognised by their white colour, microscopic sections showing them to have become normal fibrous tissue, part of the living structure of their host.

Two advantages, then, of kangaroo tendon are its strength and its durability. Another is the ease with which the tendon is split to any size required, and here I would impress the point that a medium thickness only is required in most hernia operations, and that probably there is more risk (as certainly is the case with silk) of thick sutures being resented by the tissues and having to come away.

Tendon is stronger, less slippery, and more easily manipulated than catgut, over which it has the very great advantage of persistence. One slight disadvantage it has compared with silk, knots tied with it are more likely to come untied, hence the ends should not be cut too short, and it is often best to tie a triple rather than a double surgical knot (the same statement really applies also to silk).¹

Having stated thus positively my belief in the merits of kangaroo tendon for buried sutures, based on a long and wide experience of it, I would note that its judicious

¹ I learnt the use of kangaroo tendon from Professor John Wood, who was probably the first surgeon to employ it in hernia cases in Europe, and who was, without question, *the* pioneer with regard to radical cure of hernia.

employment renders unnecessary the attempt to bury silver wire or filigree network in certain forms of herniotomy, and that the tendon sutures are not employed by surgeons nearly so much as they deserve to be.¹

2. The great majority of operators employ either silk or catgut (sometimes chromicised) for their buried sutures; in fact of most it would be true to say they have never used kangaroo tendon.

Ordinary catgut rapidly swells, softens, and gives way: chromicised gut may last three weeks or so.

With much improved methods of preparation (especially as to securing asepsis) catgut can now be obtained, which is free from the risk of causing certain grave infections—septicæmia, tetanus, etc. But that many such accidents due to deep sutures or ligatures of non-sterile catgut have occurred in the past is certain, and the possible risk should always be borne in mind.

Silk is described as a non-absorbable material for suture, but this is not wholly correct, as the following case illustrates:

In a case of strangulated inguinal hernia in a young man I was obliged to resect about 12 inches of small intestine, performing end to end anastomosis, and using fine Japanese silk for the double row of sutures. The patient made a good recovery. Some years later he died in another hospital from some cause totally unconnected with his former trouble, and my late colleague, Mr. Harold Barnard, obtained the specimen of intestine, which was placed in the London Hospital Museum. No trace was found of any of the silk sutures; a fine cicatrix ran round the intestine at the point of union, with minute

¹ The distinguished American surgeon, W. B. Coley, is a warm advocate of kangaroo tendon for buried sutures. Of 160 hernia operations (Bassini's method), in which kangaroo tendon was alone employed, 96 per cent healed perfectly and not a single relapse of the hernia was observed; all but six were traced from one to three and a half years after the operation. Coley advises that the kangaroo tendon should be lightly chromicised, and believes that it takes three months at least to be absorbed. I hold there is no object in chromicising the kangaroo tendon, and that it becomes converted into normal fibrous tissue.

scars crossing it, these showing where the interrupted silk Lembert sutures had been placed. It may be added there was no narrowing of the intestinal lumen. It is so rarely the surgeon's good fortune to see the result of his resection of intestine years afterwards that this case is of special interest. The examination of the site of a former gastro-jejunostomy operation is more frequently obtained, and has shown that fine silk sutures usually disappear entirely, presumably from phagocytic action. The undue persistence of silk sutures used for the internal row (*i.e.* those exposed to the action of the gastro-intestinal juices), and the trouble they occasionally give rise to, has had attention prominently directed to it of late years. But this subject is not strictly analogous to buried sutures in hernia operations, in which aseptic healing free from the interfering action of gastric juice is to be expected.

It is, I believe certain, though difficult of course to prove, that fine silk, whether used for buried sutures or ligatures, is usually absorbed in the long run. This must take several months at least. Fine Japanese silk is strong, stands repeated boiling well, and is a safe material for buried sutures. The same cannot be said for thick silk, which, in my opinion, should never be used in hernia operations if one wishes to avoid the troublesome complication of sinuses due to their irritating the tissues and being ultimately thrown off. Bull's experience was that deep silk sutures, "though boiled in carbolic solution," always caused small abscesses. We have certainly improved in this matter since Bull wrote, but sinuses due to buried silk are still too common.

Coley held that the use of non-absorbable material—stout silk, silkworm gut, or silver wire—should be given up in hernia operations in favour of kangaroo tendon.

I am certain that the use of kangaroo tendon in repairing ventral, umbilical, and large inguinal herniæ obviates the need for resorting to silver filigree and such like risky material.¹

¹ Thick floss silk boiled in 1 in 1000 solution of perchloride of

Messrs. Gask and W. G. Spencer¹ endorse the preference I have urged above; they write: "For suturing the hernial aperture the best material is split kangaroo tendon, the next very fine silk" (note the important qualification). "Many employ catgut, which occasionally excites severe suppuration." They are, however, mistaken in stating that the tendon "is absorbed in about six weeks." Space will not allow of quotations from other authors in favour of catgut or silk for buried sutures in hernia and other abdominal operations. I am perfectly aware that the majority favour one or other, and for this reason have been anxious to put forward the merits of kangaroo tendon.²

3. A few words must be given to buried sutures of a material that cannot possibly be absorbed—namely silk-worm gut and silver wire. Closely analogous is the use of silver filigree.

John Wood in his early work used stout silver wire, but always removed it after a week or two—a most unpleasant experience for the patient. Bloodgood used it in many inguinal cases, hoping it would not irritate and might remain permanently. A careful perusal of the reports of his cases,³ or of the late C. B. Lockwood's

mercury for an hour, then dehydrated in alcohol and preserved in parolein is strongly recommended by Mr. R. S. Souttar (*Brit. Med. Journ.*, Nov. 25, 1922). This material was introduced by Lange fifteen years ago. It is said to become organised, like kangaroo tendon.

¹ *Practice of Surgery*, p. 1001.

² It is of interest to note that I have succeeded in grafting lengths of kangaroo tendon to supply gaps in human tendons with perfect functional result. Striking confirmation of the views put forward have recently been supplied by the work of M. Jean Nageotte, *L'Organisation de la matière dans ses rapports avec la vie* (1922). He shows that a graft of tendon which had been preserved in alcohol "attracts fibroblasts, which re-colonise and reconstitute it into normal tissue; it becomes an integral part of the living organism," etc. This is precisely what I have demonstrated with regard to kangaroo tendon, though this important fact is ignored by all other surgical writers. See Review of M. Nageotte's book in the *Lancet*, Oct. 14, 1922.

³ *Johns Hopkins University Reports for 1900*.

dismal experience with the same form of buried suture,¹ will lead the surgeon to resolve "under no temptation will I bury silver wire—or silver filigree either—in a patient's groin."

The question with regard to the employment of silver filigree is treated further in the section on umbilical hernia (p. 131).

Silkworm gut stands on a rather different footing; it is less likely to irritate than rigid wire, especially if the smaller calibre gut is employed. Even the finest kind, the "ophthalmic gut," has remarkable strength, and is also perfectly supple, almost like silk.

Some surgeons do not hesitate to bury silkworm-gut sutures in bringing aponeuroses together; unfortunately, my own experience of it is small, though I have seen a few cases of obstinate sinus result from these deep gut sutures, and others in which they had given no trouble.

¹ *Trans. Med. Soc.*, 1905, p. 162.

CHAPTER III

OPERATIONS FOR RADICAL CURE OF INGUINAL HERNIA--- AFTER-TREATMENT—FINAL RESULTS AND OCCASIONAL COMPLICATIONS OF THE OPERATION

THE OPERATION FOR RADICAL CURE OF INDIRECT INGUINAL HERNIA

THE following description relates to the average case in an adult—slight modifications are likely to be made in children or young adults in whom the inguinal canal is perfectly normal except for the presence of a congenital sac or tube of peritoneum; in these cases the surgeon need only deal thoroughly with this sac, and may prefer neither to open up the canal nor to narrow it by deep sutures after doing so.

First Method. including narrowing the canal in front of the cord

It may be premised that the method described is entirely different from Bassini's in that the spermatic cord is not disturbed from its bed and the conjoined muscles are drawn down and fixed by suture *in front* of and not behind the cord.

The objects to be aimed at are (1) the isolation and complete removal of the hernial sac, its ligature as high up as is possible (close to the internal ring, where it has come off from the peritoneum), and the fixation of the stump securely above this point; (2) to strengthen the canal by restoring the valve-like action of the conjoined muscles without making undue pressure on the cord.

The Instruments Required.— Besides those required in any other surgical operation ¹ the following should be provided :

(a) Fine-toothed forceps of the pattern known as fixation forceps in ophthalmic work, but somewhat larger and stronger than the latter. They are invaluable for dissecting off the surrounding tissues from the hernial sac.

(b) A mounted needle on a handle. This needle is slightly curved on the flat towards its eye, which latter should be large enough to carry the tendon suture. The needle point need not be very sharp. Some operators still use the corkscrew-curved needles invented by Sir William Macewen. In my opinion there is no special indication for these in hernia operations—most of the suturing is best done with ordinary fully-curved needles and a suitable holder; in fact, the special mounted needle just described, though very convenient, can be dispensed with if necessary. Blunt hooks and Cheyne's dissectors are very useful.

(c) For passing ligatures through omentum there is nothing better than an aneurism needle. If the operator when fixing the sac stump chooses the method of drawing it through the muscles (p. 61), it is advisable to have an angled pair of Wells' forceps for the purpose.

As to the choice of suture material it is useless to expect uniformity of practice. I prefer to rely on kangaroo tendon for practically all buried sutures, fine Japanese silk or catgut for ligatures, and fine silkworm gut for closing the wound.

Some surgeons of experience "plump" for catgut.

For the discussion of this interesting matter see p. 46.

The Incision, etc. The whole of the pubic region on both sides is shaved, cleansed, and carefully disinfected on the evening before the operation. A mild

¹ The Spencer-Wells' forceps in common use is too big and heavy. I strongly recommend lighter and smaller ones, which get less in the operator's way and are just as effective.

antiseptic compress is bandaged on. When the patient is anæsthetised and on the table a solution of 2 per cent of iodine in absolute alcohol ¹ is painted over the operation region, *i.e.* above and below Poupart's ligament and the scrotum. The penis and thighs, etc., are covered with sterilised towels: in fact the area left uncovered is quite small, as the incision will be limited to that immediately over the inguinal canal. The operator identifies the pubic spine and external ring with his finger, maps out the line of Poupart's ligament, and then makes a linear incision which commences over the ring and runs for three or four inches parallel to and above the ligament (Fig. 12).

This incision goes straight down to the external oblique aponeurosis, which is the first landmark recognised; when it is exposed, the handle of the scalpel should be used to clear both the external ring and the aponeurosis upwards and downwards. In making this incision the superficial epigastric vessels and perhaps the superficial external pubic ones are divided, and should be at once secured with pressure forceps. These forceps should be held up by the assistant, as they serve as excellent retractors. Towards the end of the operation these small arteries and veins must be tied with catgut or fine silk.

The next step is to incise the external oblique over the whole length of the canal; this incision is made through what is usually a weak and thin part of the aponeurosis, and so far from weakening the anterior wall the subsequent method of suturing, if carefully carried out, renders this part stronger than it was before.²

¹ Iodine dissolved in ethylic alcohol or impure spirit is singularly irritating to the operator's and assistant's eyes.

² It is true that many operators, fearing to impair the strength of the canal wall, do not open it up in this manner. In the case of some young children the step may be unnecessary; in all other cases it is strongly advised. This teaching is supported by Spencer and Gask, who put it well, "The division of the external oblique aponeurosis in the line of its fibres, afterwards closed by suture, is not a source of recurrence" (*Practice of Surgery*, p. 1001).

The two borders of the external oblique are cleared by blunt dissection and held apart: beneath the upper one the ilio-inguinal nerve should be looked for, isolated, and in the subsequent placing of sutures *this nerve must not be included*.

The lower border of the aponeurosis is cleared down to Poupart's ligament by gentle use of the blunt dissector, which loosens the cord slightly from the external oblique.

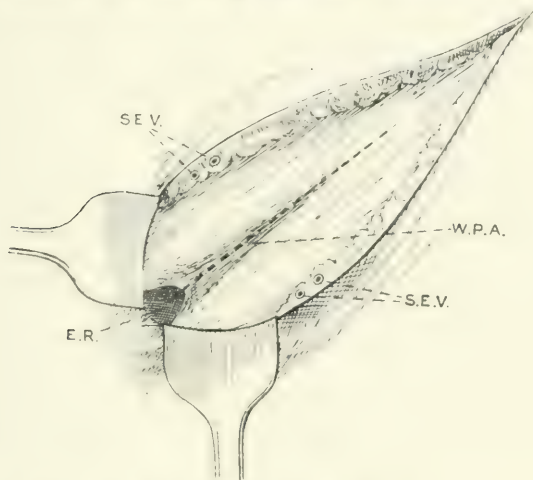


FIG. 12. First stage of radical cure of inguinal hernia. E.R. the external ring, from this the dotted line indicates the incision made through W.P.A., the weak portion of the aponeurosis covering the inguinal canal. S.E.V., the superficial epigastric artery and vein.

The edge of the conjoined muscles is now well defined, and the cremasteric covering of the cord identified by its longitudinal bundles of pale muscle fibre: an incision between these bundles will traverse this and the infundibuliform layer so as to expose the sac. More is really done by blunt dissection with two pair of forceps than by cutting.

Isolation of the Hernial Sac.—The thickness of fascia round the sac and the exact position of the constituents of the cord in relation to it vary greatly. As a

rule, the vas deferens lies behind and below the sac with its vessels, the other veins and spermatic artery are spread out, and some may be in front of the sac. It is necessary to strip these carefully away, with especial care as to the vas deferens, which is recognised by its whipcord-like feel and appearance. The spermatic vessels must not be grasped by the forceps. The use of the small serrated ones makes it easy to detach them without risk of damage. The sac wall itself is recognised by its white colour, perhaps by seeing or feeling omentum or intestine slip beneath it, etc. During this isolation of the sac it must be understood that the operator is working at right angles to its axis, and close up to the internal ring. He wants to clear the neck of the sac all round, much as an artery is cleared in order to pass the aneurism needle; in both cases a short area of clearance suffices.

The closer he is working to the internal ring the easier will be this step. With the fingers of the left hand the sac-neck is raised; with those of the right the constituents of the cord are peeled off from it. Again the comparison to preparing a main artery for ligature comes in, the surgeon works round first from one side, then the other. The vas deferens will in all probability be the last structure to be detached. The edge of the sac always shows as a distinct line.

Does it help to open the sac and insert the finger as in a glove (as C. B. Lockwood and other writers recommend)? I have found that as a routine it is much better not to open the sac—unless its contents are adherent, when of course this must be done—usually the omentum, etc., can be easily squeezed back by gentle pressure.

The vas and other constituents of the cord are held aside if necessary by blunt hooks—the neck has been isolated all round high up—the chief difficulty in the operation has been overcome. Working down from this isolated portion the adherent tissues are readily detached until the fundus of the sac is reached, a few cuts with the scissors may be required to divide the lowest strands

(in some cases remains of gubernaculum or connection with the tunica vaginalis). If the hernia is a congenital one, as the sac is pulled out of the scrotum, the testis will appear uncovered. In such a case it is easy to tie or sew off a small tunica vaginalis grasping the sac itself in Wells' forceps. By means of the latter the sac is twisted and held up (Fig. 15), the fingers of the left hand having reduced and held back any contents of the sac.

Excision of the Sac and Fixation of its Pedicle.

The operator holding the twisted neck of the sac as high as is practicable (*i.e.* close to the deep epigastric vessels), and the assistant raising the twisted sac, the mounted needle, threaded with tendon or catgut, is made to transfix the neck just below the fingers of the operator's left hand. A Staffordshire knot is tied—very securely—the two ends of the ligature left long, and the sac cut away with scissors a short distance below the knot. Each end of the ligature is then in succession threaded on the needle, which is guided by the left index finger beneath the muscles, and made to emerge from within outwards at least an inch above the position of the internal ring.¹ The two points at which the needle perforates all three muscles are a short distance from each other, and the ligatures are now tied in a firm knot. Thus the pedicle or stump is anchored behind a specially thick part of abdominal wall, near the level of the anterior superior spine.

As an alternative to this anchoring of the stump, many surgeons simply cut the ligatures short and leave the stump free—but I believe fixation to be the best. Some other methods of dealing with the sac will be discussed later (p. 60).

Narrowing the Inguinal Canal. The cord with its

¹ It might be thought that the passage of the needle here would endanger the deep epigastric vessels or present some difficulty. This is not so—the left index finger easily clears its way beneath the muscles, the needle is passed along the finger, and is moreover directed *away from* the vessels towards the anterior superior spine.

coverings is retracted slightly inwards, the lower border of the external oblique raised with forceps, and two or more mattress sutures passed by means of ordinary curved needles through the aponeurosis just in front of Poupart's ligament, then through the conjoined muscles near their edge, and back through the aponeurosis.

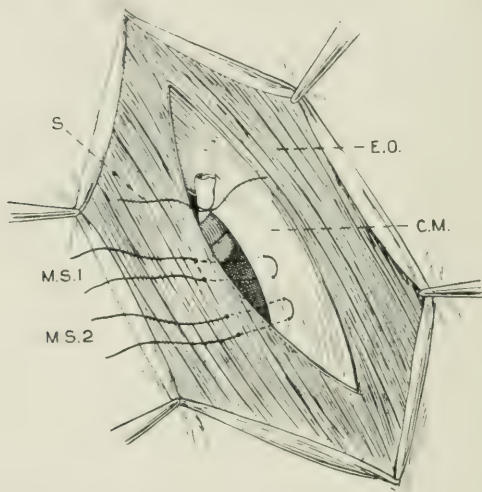


FIG. 13. — Radical cure of indirect inguinal hernia. Note that for sake of clearness the spermatic cord is not shown, the two mattress-sutures (M.S.1 and M.S.2) would lie wholly in front of it. The external oblique aponeurosis (E.O.) is opened up and everted so that the conjoined muscles (C.M.) are well exposed. The deep epigastric vessels are seen with the ligatured stump of the sac immediately above them. The sutures which draw down the conjoined muscles are introduced from the *outer aspect* of the external oblique and tied on the same—outer—side; this is hardly made clear enough in the diagram.

This is rendered easy by the previous clearing, already described. A good hold of the conjoined muscles must be secured, and care taken that the ilio-inguinal nerve is not included in either of the loops, as may easily happen. Whether two or three mattress sutures are passed will of course depend on the needs of the individual case—

traction on the ligature ends before they are tied will prove how effectively the canal is narrowed or braced up, without injurious constriction either of the cord or of the conjoined muscle fibres. The knots are now securely tied on the external surface of the aponeurosis.

Suture of the Divided Aponeurosis.—This should always be done by interrupted sutures, beginning from the upper end of the wound, taking care to make the union close and firm but not to narrow the external ring too much (it should allow insertion of one's index finger, as in the normal condition).

If the hernia has been large, the canal stretched, and the aponeurosis lax, it is a good plan to make the two edges overlap by a double row of sutures.

Any vessels in the subcutaneous layer that have not already been secured should be tied, and it only remains to sew up the skin wound, and to apply the dressing.

The Dressing and Bandage.—After a careful trial of various ways of dressing a herniotomy wound the writer came back to a pad of simple sterile gauze, the lower layers of which have been wrung out of a weak antiseptic solution, a layer of absorbent wool over this, the whole being kept in place by a spica bandage of light material, and a second one of elastic-webbing bandage pinned to the former.

The last named (see Fig. 14) is most useful in case the patient is restless or sick on coming round from the anæsthetic, moreover in the next few days it keeps the dressing in accurate position with gentle pressure over the wound. The bandages are applied with the patient's pelvis steadied on a support, and his thigh flexed: of course it is easy to put on the bandage too tightly, and this should be tested with the hip in extension. The scrotal region should invariably be left outside the dressing, and may be supported on a small pillow.

After hernia operations on infants or very young children it is probably best to dispense with dressing and bandage—to keep boracic acid freely dusted over the

suture line and a sterile towel pinned round the pelvis over this, the child's knees being lightly fastened together. Careful nursing will do the rest.

In adults gauze soaked in collodion or celloidin solution has been widely employed as the only dressing—

the bandage being dispensed with. I have given above the reasons for preferring the support of a pad and elastic-webbing bandage—moreover, in spite of every care I found these adhesive and air-tight dressings apt to chafe or irritate the skin.

Various Methods of dealing with the Hernial Sac and its Contents.—(a) It has recently been proposed as a routine method that the sac should not be excised, but a ligature merely put round its neck. Some slight trouble to the operator may thereby be saved and the operation shortened, but such an argument ought not to

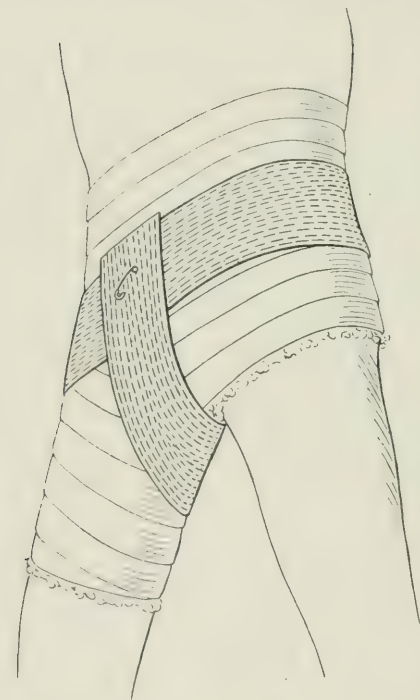


FIG. 14.—Figure - of - eight bandage of elastic webbing applied over the ordinary one and dressing after operation for radical cure of hernia on the right side. Even pressure is thus secured.

influence one in the least if the result thereby is impaired, which it certainly is. A hydrocele of the hernial sac below the ligature will probably form, rendering a second operation necessary. Nothing more need be said about this proposal, which is in no way an improvement.

Professor A. E. Barker had previously advised leaving the lower part of the sac in the scrotal tissues if its removal was found to be difficult. But by traction from above and the careful use of the forceps and gloved finger it will be found practicable to remove the whole sac in practically every case—such has been my experience in many hundreds of such operations.

(b) Sir William Macewen introduced a method in which the sac is retained after it has been wholly freed, a suture being passed through its lower extremity and knotted, then passed repeatedly through it so that when drawn tight the sac is pleated or bunched up into a pad which is finally fixed at the upper end of the inguinal canal. The suture is brought through the abdominal muscles and tied—the folded sac thus forming an obstacle to recurrence of the hernia.

This plan is still in use by many surgeons, especially in the north, and is a very good one where the sac is of small size.¹

(c) Torsion of the neck of the sac is undoubtedly useful in tightening up the peritoneum behind the internal ring. A good way of maintaining this torsion of the pedicle is the following, which is a variant on the method described on p. 57, and which I have practised in a great many cases. *It should only be used, however, where the sac wall is comparatively thin.* After complete isolation of the sac its neck is grasped in Wells' forceps so as to leave a pedicle a few inches long, the rest is cut away. In many cases the latter step will be unnecessary owing to the sac being fairly short. Torsion is made, the left index finger passes under all three muscles, beneath which (a short distance above the internal ring) its tip is made to project forwards, and on to it a small incision is made so as to allow a narrow pair of forceps to be introduced

¹ If the pleated sac be used as a pad to block the upper entrance to the inguinal canal it is important to fix it as high as practicable, *i.e.* in the sub-peritoneal area. If left in the canal it would only favour recurrence. A large or thick sac is wholly unsuitable for this method.

from without inwards.¹ This follows the track of the withdrawing finger, and its closed end is made to project forwards, it is then opened so as to grasp the twisted sac

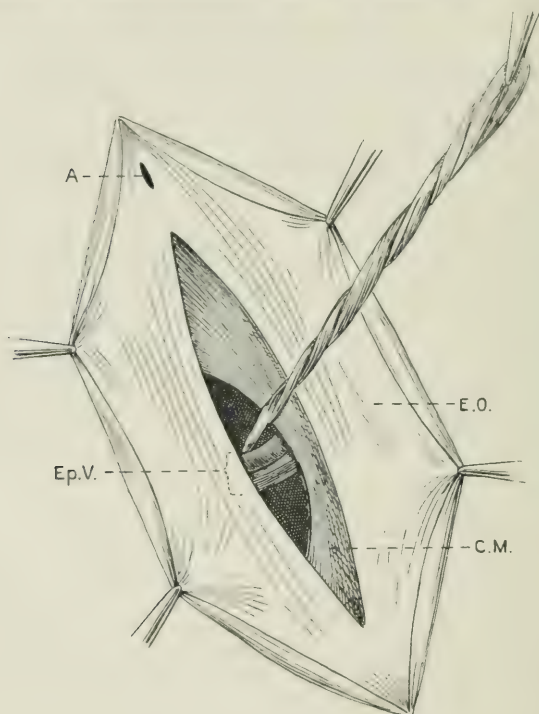


FIG. 15. Diagram showing method of twisting the sac and fixing it in a small aperture made through the muscular wall at A near the anterior superior spine. A forceps would be brought through A from without inwards and made to grasp the twisted sac, then withdrawn, and sutures applied as shown in Fig. 16. The spermatic cord is not represented for the sake of clearness. Ep.V., the deep epigastric vessels. E.O., the external oblique aponeurosis. C.M., the conjoined muscles.

from which the lower pair of forceps is removed. In

¹ A special pair of forceps bent with a very open angle is useful for this manoeuvre—but dressing or sinus forceps will serve instead, though not so well.

this way the pedicle is drawn out through the small upper incision, is twisted again and secured by two sutures, as shown in Fig. 16. After these have been tied the superfluous part of the sac is cut away.

It might be urged against this method that a fresh hernia can form through the small opening in the muscles. It is, however, effectually plugged, and I have never known recurrence to happen at this site.

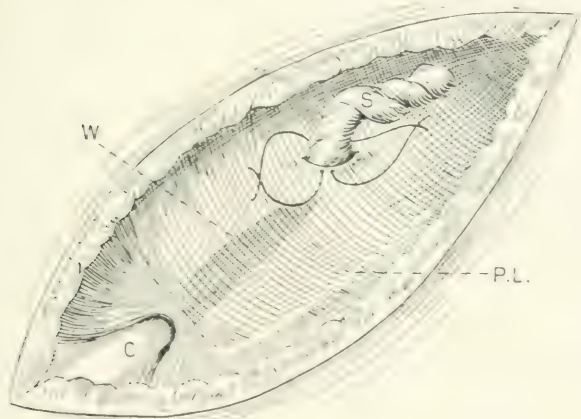


FIG. 16. — Radical cure of inguinal hernia: the sac is twisted and brought through a small opening in the abdominal wall, to be fixed there by two sutures traversing the edges of the opening and the sac. These would be firmly tied. C, the spermatic cord. P.L., Poupart's ligament. W, the weak area in the external oblique aponeurosis: this as a rule is opened up early in the operation.

NOTE ON TORSION OF THE SAC. — Sir Charles Ball of Dublin and the late Professor Kocher of Berne were warm advocates of twisting the sac and of securing the neck by sutures whilst torsion is still maintained. Many surgeons do not favour it, and allege (what is certainly true) that now and then a piece of omentum or a knuckle of intestine has been twisted at the same time as the neck of the sac, with serious and occasionally fatal results. I have never known this accident to occur, and consider that it cannot do so if the operator with his left hand ascertains that the upper part of the sac is empty whilst

the torsion and passage of the anchoring suture is carried out. It is neglect of this precaution that has led to accidents.

In favour of torsion of the sac it may be pointed out that it renders its isolation easier, keeps it empty, and if maintained by the anchoring sutures the twisting undoubtedly braces up the peritoneum in the neighbourhood. Sir Charles Ball even stated that he had known torsion of an inguinal sac produce a cure of a femoral hernia in the same side from the effect just stated !

There are a few other methods of dealing with the hernial sac, including two associated with Professor Kocher's name, but I cannot see that they possess any special advantage and therefore omit their description.

The Contents of the Sac with regard to the Operation for Radical Cure.—In the preceding account it has been assumed that either the sac is found to be empty or else its contents can be reduced by finger pressure and prevented from descending whilst the sac is dealt with. In such cases, forming the great majority, there is no reason whatever for opening the sac.

But where omentum, or more rarely intestine, cannot be returned owing to adhesions, it is of course necessary to open the sac. This should be done a short distance below the internal ring if possible, in order to leave an intact neck for transfixion by the needle, etc.

(a) The omentum most commonly has to be dealt with, being either adherent or having undergone local hypertrophy. It must be freed completely, but it is best to disregard any adhesions low down (*i.e.* to the fundus of the sac) and to isolate the pedicle, to spread this out, and to secure it by several catgut ligatures introduced on an ordinary aneurism needle (or by transfixing the omentum with fine forceps holding a ligature).

Stress must be laid on securing the omental vessels with ligatures *which do not interlock*, which constrict only a small amount of the membrane, and which are tied very tightly. In several cases death has resulted from slipping of an omental ligature after the pedicle has returned

within the abdomen, and disaster has also followed the application of ligatures close to the transverse colon (*i.e.* where the omentum is prolonged from this). I invariably tie a triple reef-knot when dealing with omentum, and often use fine Japanese silk instead of catgut—owing to the slipperiness and tendency of the latter to soften.

Once again, in this very important step of the operation, it is best to leave the long ends of the ligatures hanging until all have been tied and the mass cut through below knots. One then makes sure that each ligature is holding well, and that no vessel has escaped, before cutting the threads short and returning the stump into the abdomen.¹

When reducing the contents the edges of the sac opening should be held with two pairs of Wells' forceps, traction on which will fix the neck and facilitate the return of either intestine or omentum.

With regard to the small intestine it is rare to meet with trouble in reduction. Slight adhesions can be readily dissected off, now and then it may be necessary to return portions of firmly adherent sac with the gut. The question of the vermiform appendix in a hernial sac and its appropriate treatment is discussed elsewhere (p. 179). The cæcum or sigmoid colon if present in a hernia (usually a large one) will hardly offer special difficulty unless the case is one of incomplete or imperfect sac—the viscus having slid down carrying with it its peritoneal attachment. Under these circumstances the operation may be an arduous or even formidable one, and will fully tax the operator's resource and skill. It may be found impossible to dissect the prolapsed part of large intestine free of all adhesion, and to do so might endanger its blood supply. The safest plan, speaking generally, is to return within the abdomen that portion of the sac to which the cæcum

¹ The details given as to dealing with the omentum apply to the radical cure of umbilical hernia even more strongly than to that of the inguinal variety. In umbilical there is a special risk of applying the ligatures too close to the colon.

or sigmoid is firmly united, working carefully round it with scissors. Obviously in such a case any formal or routine method of dealing with the sac-neck cannot be carried out, but some "patch-work" suturing may be effectual, and once the viscus has been returned the inguinal canal must be strengthened by buried sutures as firmly as is practicable.

In the condition of sliding cæcum or sigmoid special difficulty may be met with in detaching the spermatic cord from the sac, and after this has been done the operator may decide to follow Halsted's method as the most suitable (p. 72).

Finally, although an ideal result may not be obtained, provided the intestine has been returned within the abdomen, the use of a light truss will prevent recurrence.

Reference must now be made to an occasional but very important inmate of the hernial sac—namely, a portion of the urinary bladder. The following points may be noted: (1) The protrusion really forms part of the inner wall of the sac, it is only partially covered with peritoneum. (2) It is probably covered with fat, and apart from forming an abnormal thickening or projection may suggest very little its true nature. The best operators have gone astray in this matter and have incised the protruding bladder wall—sometimes with fatal results.

This rule should be invariably followed. Whenever a thick, fat-covered elevation is found on the inner side of the sac, the nature of which is not easy to determine, the surgeon should suspect a hernia of the bladder, and carefully refrain from cutting into it to demonstrate its nature. Torsion and displacement of the neck of the sac should be practised with due caution when a protrusion of the bladder is suspected.¹ If by accident the latter be incised, its wall should be sewn up with Lembert's sutures and provision made for drainage of the wound.

¹ It may be possible in a doubtful case to verify the nature of the protrusion by the assistant passing a catheter and distending the bladder with water.

Retention of a catheter is not necessary. Several such cases have recovered without leakage or other complication. The bladder, after all, but rarely causes any difficulty in herniotomy, though Curtis and Gibson have collected records of 103 cases in which it was wounded during the operation, with a direct mortality of 12 per cent.

In my own experience I have seen this complication—presence in the hernial sac of a small part of the bladder—in four or five operations. In only one of these was the mistake made of cutting into it—in the others the protrusion was recognised, freed, and safely returned within the abdomen. In the case referred to, I fortunately realised what had occurred, and sewed up the wound in the bladder wall without any harm resulting.¹

In one remarkable case of large right inguinal hernia a thick-walled cyst was met with bulging on the inner side of the sac. Having made certain that it did not communicate with the bladder, I opened it—*letting out straw-coloured fluid like urine*—but its origin remained a complete mystery. In this case there was also a sliding cæcum, and for both these reasons the operation proved one of the longest and most difficult I have ever met with. It afforded a striking instance of the unforeseen difficulties that may arise in some cases of radical cure operation.

Second Method, narrowing the canal behind the cord

Bassini's Operation. Bassini made a real advance in the surgery of inguinal hernia by proving that the canal should be laid open along its whole length, in order to strengthen its walls by suturing the conjoined muscles to Poupart's ligament behind the cord. Previous to the publication of his method, which spread with surprising rapidity to surgical centres all over the world,

¹ Even if the protruding bladder be recognised in the hernia in time to prevent its incision, considerable trouble may be met with in dissecting it free from the rest of the sac and in returning it within the abdomen. Some cases of serious hæmorrhage have occurred in this connection.

operators had avoided the division of the front wall of the canal lest a ventral hernia should thereby be produced. By the ingenious methods of Professor Wood and Sir William Macewen it was possible to narrow the canal to some extent without laying it open first, and so to restore the valve-like action of the conjoined muscles. The latter were drawn down *in front of the cord*, for without completely opening up the canal it would have been dangerous, and indeed useless, to attempt to suture them to Poupart's ligament posteriorly. It simply could not be done, and even the manipulation of the conjoined muscles in front was carried out in the dark, and was therefore not always satisfactory.

There is yet another point in favour of the open method, that the sac can be isolated and properly dealt with only towards the internal ring.

By Bassini's method two definite improvements were introduced, first the free exposure of the spermatic cord from the internal to the external ring; secondly, the detachment of the cord from its bed and its elevation in order to draw down the conjoined muscles and fix them to Poupart's ligament—thus narrowing the internal ring. Of these two, in my opinion, the first is by far the most important, the second being open to some objection and having been abandoned by many surgeons as a routine procedure. With or without some modifications Bassini's method is, however, still (in 1922) the one most widely practised and taught, and the following details as to its performance may be noted, omitting those common to all operations for radical cure :

1. The external incision is a long one, reaching from the external ring to about 1 inch internal to the anterior superior spine. The external oblique is divided to the same extent, and both internal and transversalis muscles are slightly cut towards the internal ring so as to expose the latter.

The sac is isolated, securely ligatured, and its stump returned without any attempt to anchor it in position.

2. The spermatic cord (including the vas deferens, pampiniform plexus and arteries, etc.) is carefully isolated by blunt dissection and retracted upwards. Beneath this a row of four, five, or more interrupted sutures is carried across from the lower edge of the conjoined muscles to the inner side of Poupart's ligament, which is made evident by slight traction on the outer lip of the external oblique aponeurosis (see Fig. 17). These are

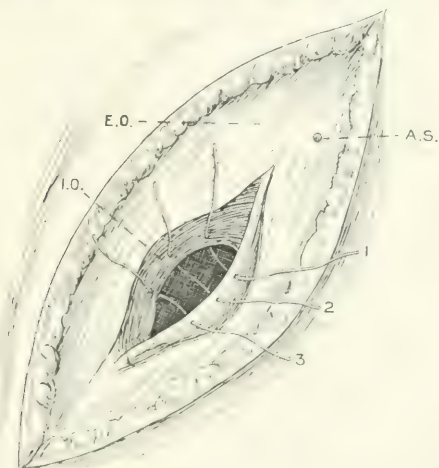


FIG. 17. — Radical cure of inguinal hernia (Bassini's method). For clearness the spermatic cord is not drawn in, it would have been raised from its bed and held forwards. A series of interrupted sutures (1, 2, 3) draw down the conjoined muscles to Poupart's ligament. A.S., region of anterior superior spine. I.O., internal oblique and transversalis. E.O., external oblique aponeurosis.

knotted, producing a fourfold effect—the posterior wall of the canal is strengthened, the position of the internal ring is slightly raised, the ring itself is narrowed, and the former bed of the spermatic cord is filled up so that the latter will come to lie a little higher and more anterior than it did before.

3. The cord being "replaced," the external oblique is sewn up in front of it by a series of interrupted sutures.

It is obvious that by Bassini's method the inguinal canal is effectually narrowed, indeed it is easy to overdo this and to leave insufficient room for the spermatic veins towards the internal ring. Partly from this cause, and sometimes also from too rough handling of the veins whilst the cord is being retracted from its bed, many cases of thrombosis of these veins have occurred as a result of Bassini's operation. There are other definite drawbacks to the method.

It is not infrequent to find in the inguinal canal, resting on and about Poupart's ligament, anastomosing veins between those of the cord and the pubic plexus going to the internal iliac veins. If these are present they will have to be divided when the cord is raised and may give trouble.

A more important objection is the pulling down and fixation of the conjoined muscles to Poupart's ligament. Every surgeon with experience of these operations knows how much the conjoined muscles vary in different individuals. They may be well developed with thick lower edge, and it may be easy without undue traction to fix this lower edge at the level of Poupart's ligament. On the other hand the lower edge of these muscles, the so-called conjoined tendon, may be thin and only to be drawn down with difficulty. What will happen in such cases? If there is undue tension the union will either give way later, or else the patient will experience a dragging sensation in this region when he gets back to work and to free movements of the abdomen. That this is not imaginary was impressed upon me by several cases in working men on whom I had performed the orthodox Bassini operation; for some time afterwards they could point to the exact spot where an uncomfortable sense of tightness or strain was felt, and there was no other explanation open than that the "conjoined tendon" was fixed too securely at a lower level than it would well allow.

It would seem that this traction on the conjoined

muscles in some cases has the effect of opening up the femoral ring immediately below, and thus leading to a femoral hernia on the same side as the inguinal operation. Mr. Pendlebury of St. George's Hospital informs me that he has observed two or three instances of this curious result, where Bassini's operation had been done only too thoroughly. In my own experience I have met with one case of femoral hernia developing after, and on the same side as the inguinal operation.

Again, it will be granted that the natural bed formed for the cord by the concave surface of Poupart's ligament uniting with the transversalis fascia and arched over by the two muscles is an ideal one, and the new one left by Bassini's method is distinctly inferior to it.

Hence after considerable experience I almost entirely gave up performing Bassini's operation for a method which effectually restores the valve-like action of the conjoined muscles without causing undue strain on the sutures, and at the same time avoids lifting up the cord from its natural position. This method is described on page 58. It differs entirely from Bassini's operation in that the inguinal canal is narrowed by drawing down the conjoined muscles *in front* of the cord, and the cord itself is not disturbed from its bed.

Many surgeons claim to do a "modified Bassini," and no doubt correctly so. Others regard as their own methods which differ but little from the original described by the Italian surgeon. For example, Waring¹ describes as his own operation one in which the cut and twisted neck of the sac is secured by a suture passed through the muscles at the upper end of the wound. Moreover, these conjoined muscles are not divided at all over the internal ring (probably Bassini himself left off this slight division which is quite unnecessary). But in all the essentials — especially the complete elevation of the cord and the suture of the muscles behind it to Poupart's ligament — Waring's is exactly the same as Bassini's operation.

¹ *Manual of Operative Surgery*, pp. 153 to 157.

Third Method

Transplanting the Spermatic Cord and Obliteration of the Inguinal Canal.—This method, first introduced by Halsted, has never come into vogue as a routine measure, but is reserved for exceptional cases. It consists in raising the spermatic cord from its normal bed and bringing it in front of the external oblique, the walls of the canal being then sutured together from the internal ring downwards. A brief description will suffice. The canal being freely laid open the hernial sac is dealt with by one of the methods already described, the spermatic cord and its investment is then carefully raised—from the level of the internal ring down to the os pubis. It is then held forwards by blunt hooks or retractor, and a series of interrupted sutures are passed through the edges of the external and internal oblique and the transversalis on one side, and the lower part of the external oblique on the other (see Fig. 18). The lowest sutures will pass only through the former pillars of the external ring. If necessary one or two sutures are passed above the new aperture for the cord, but the latter must not be made too narrow or the blood supply of the testis will be interfered with. Halsted made a point of excising some of the veins of the pampiniform plexus, but there is no object in interfering with these unless there is a coincident varicocele.

A word of caution is necessary as to the deep epigastric vessels. In passing the uppermost sutures it has happened occasionally that the epigastric artery has been wounded, leading to serious hæmorrhage and even necessitating ligature of the external iliac artery.

In raising the cord so as to pass the deep sutures it should be remembered there is some danger of causing thrombosis of the spermatic veins, a complication which has also followed narrowing the aperture for exit of the cord too closely.

Beyond the formation of a hard lump above the

testicle, and possibly œdema of the scrotum, little harm is likely to ensue, but symptoms of pulmonary embolism have occasionally been recorded—a most dangerous complication.

Hence the operator should be careful, when performing Halsted's operation, to avoid undue traction on the

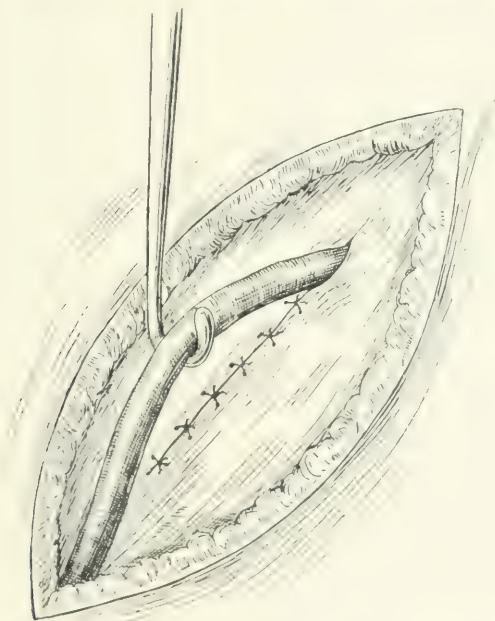


FIG. 18. — Halsted's operation for inguinal hernia. The spermatic cord is brought forward on to the surface of the external oblique, the inguinal canal being closed by a series of interrupted sutures.

spermatic vessels, and to allow sufficient room for their passage through the abdominal wall.

Finally, care should be taken not to include the ilio-inguinal nerve when closing the canal, it should be brought forward with the cord or else resected.

My own experience with Halsted's operation has been small: its use having been limited mainly to recurrent herniæ or to those in which the inguinal canal has been

much stretched and shortened by a voluminous hernia. The results in these cases were good on the whole, but Spencer and Gask¹ point out the dangers of Halsted's operation with an emphatic warning. Amongst its results or complications they enumerate (1) hydrocele, (2) orchitis, (3) atrophy, or sloughing of the testis, (4) recurrence of the hernia at the weak spot in the abdominal wall created by the passage directly forward of the cord.

There is probably considerable force in the latter contention.

In *inguinal hernia in women* we have no spermatic cord to think of and the round ligament may be ignored. Hence after laying open the canal and dealing thoroughly with the hernial sac the canal is obliterated by deep sutures as completely as possible. No cases are more favourable for the operation of radical cure than these, as it may be said that recurrence *should* never take place.

Operations on Hernia performed from above, i.e. within the Abdomen.—Many years ago, I think in the 'eighties, Lawson Tait brought forward a few cases in which he had closed a hernial orifice from above, after opening the abdomen by the usual median incision. I reported a successful case of strangulated para-vesical hernia treated by this method—here a small pouch lay alongside the bladder in the pelvis, a knuckle of gut had become nipped within this pouch. I succeeded in enlarging the constriction, the gut was released and the neck closed by sutures. The operation was difficult owing to the deep position of the pouch, and of course it would have been impossible either to detect the hernia or to treat it without abdominal section. Several cases of obturator hernia have been treated in a similar way, the diagnosis having been made of intestinal obstruction and the hernia only recognised after the surgeon had opened the abdomen. It is in fact the easiest way of dealing with obturator hernia, and the only method for

¹ *Practice of Surgery*, p. 1000.

the rare varieties of internal hernia, such as the para- or retro-caecal, that into the fossa duodeno-jejunalis, etc.

The above refers to cases in which the operator opens the peritoneal cavity freely in order to gain access to a hernial orifice. Whenever resection of a loop of intestine becomes necessary in the ordinary operation for strangulation, I believe it is far the best course not to attempt the resection from within the sac, but to do abdominal section and to draw up the hopelessly damaged loop through the second incision. The delicate operation of resecting and suturing the two ends can then be performed and the mesentery dealt with far better than in the limited space provided by the herniotomy wound. Moreover, when the suturing is completed the loop is gently dropped back through the upper (abdominal) incision instead of having to be squeezed back through the hernial canal (which of course has been enlarged by stretching or incision). For further details on this important point see page 244.

Probably no surgeon would now think of reverting to the old practice of operating on a strangulated hernia without opening the sac, but many advocate the performance of simple radical cure of femoral hernia in this way, working down in the subperitoneal tissue to the femoral ring from above Poupart's ligament. (See the chapter on "Femoral Hernia," p. 143.)

Is it ever advisable to deal with inguinal hernia in this way? Sir Lenthal Cheatele has recently¹ brought forward a series of cases (over thirty in number) in which he performed a novel operation of this sort, and advocates it "in females of any age, and all uncomplicated inguinal herniæ in males over seven or eight."

He would not advise it in "direct hernia, irreducible enteroceles, hernia in male children under seven or eight, and hernia of long standing in which the internal opening has been dragged down opposite the external."

¹ Cheatele, *Section of Surgery, R.S.M., London, Proceedings*, Dec. 7, 1921.

It should be noted that in some of the cases the sac had to be opened in order to deal with adhesions of omentum, etc., and further, an important point arises—by this subperitoneal route it is possible to narrow the femoral ring, but in the far more common cases of inguinal hernia nothing can be done to brace up the walls of the canal—to restore it to a normal condition. Only the sac is dealt with, though we may admit this is in *most* radical cures the chief item. Before discussing other objections to the method, it will be best to make it clear by the exact words of the author. As already stated it is undoubtedly an original and novel form of operation.

“Several cases in quick succession presenting difficulties in the efficient excision of the sac led me to devise a new method by which these and other troubles could be easily and successfully dealt with when they arise.

“I approach and reach the back of the inguinal canal from a middle-line incision in the lowest part of the abdominal wall. Unless compelled by some complication I do not open the general peritoneal cavity. All the work is done in a space made in the subperitoneal tissue. I have operated in this way upon forty-one patients. In the first nine I made all the incisions longitudinal. In the remainder I have traversed the abdominal walls by Pfannenstiel's method. I will describe an uncomplicated operation. The patient is placed in the Trendelenburg position and the operator stands on the side opposite the hernia. A transverse skin incision 4 or 5 in. long is made $1\frac{1}{2}$ in. above the symphysis pubis. Its centre corresponds with the middle line. A transverse incision is made in the aponeurosis of the rectus abdominis of both sides, care being taken not to injure either linea semilunaris. The linea alba is undercut upwards and downwards, to within 1 or 2 in. of the umbilicus, and to the symphysis respectively: in doing so the sheath of each pyramidalis muscle will be opened. The opening thus made in the aponeurosis is retracted up and down and the subperitoneal tissue exposed by separating the abdominal muscles in the middle line. The peritoneum and its contents are pushed up on both sides; and if necessary kept up by packing. Two retractors are inserted on the side

of operation. The retractors should have long, separate and blunt prongs. The lower retractor, by far the most important instrument in the operation, should pull the abdominal wall downwards, outwards and forwards. Forwards to lift up the abdominal wall. Its prongs should reach the deep epigastric artery and vein. I should not advise any one to proceed with the operation until he is satisfied that this retractor is in its proper position. The upper retractor pulls the structures outwards. After more completely pushing upwards the outer part of the peritoneum and thoroughly exposing the iliac fascia the neck of the sac can be seen entering the inguinal canal. The deep epigastric artery and vein are delimited and separated from the inner part of the neck of the sac. Cheyne's dissector is a very useful instrument to use for this purpose. The spermatic veins and vas deferens with its vessels are found and separated from the whole length of the exposed sac. These structures are usually on the outer and under surface of the sac. Having cleared the sac it is pulled out of the canal by gentle continuous traction in the direction in which it lies. If there are no indications of the possibility of its easy extraction the sac is cut and the canal portion replaced. (Congenital herniæ would belong to this type.) The neck of the sac including part of the parietal peritoneum is then transtixed and removed. Finally the inguinal canal of the opposite side is examined, and if abnormalities exist they are treated on the same lines. I have only once had to ligature a vessel in the subperitoneal space, and that was a small branch of the deep epigastric vein."

In the operation advised as the routine one for radical cure of inguinal hernia (see p. 56) stress is laid upon isolating the neck of the sac *close to the internal ring*, and then proceeding to clear the sac from the constituents of the cord from above downwards. There is really no difference in the level at which the sac is isolated and ligatured between this and Cheatle's operation, but the latter cannot allow such efficient exposure—one must be working more in the dark, and one must be more troubled with the deep epigastric vessels. The idea of blindly dragging up the sac—one knows how firmly it adheres

in old hernia cases to the other structures in the cord—cannot appeal to any surgeon experienced in hernia operations.

All cases of congenital hernia are unsuited for Cheate's method, by its advocate's admission.

Finally, when omentum is present in the sac and adherent to its wall, the ordinary operation seems to be much the best—as it enables the surgeon to tie off separately the omental pedicle, to return it within the abdomen, and then to deal separately with the sac itself. By Cheate's method there is an obvious risk of tying sac and omentum together and thus fixing down the latter in the neighbourhood of the internal ring—the very thing one wishes to avoid in such cases. Other objections could easily be mentioned did space permit. For these reasons it seems most improbable that the route from above will supersede that through the inguinal canal, though the novelty of the method justifies its having been discussed at length.

AFTER-TREATMENT IN RADICAL CURE CASES

How long should the patient be kept in bed after the operation for radical cure?

For the average uncomplicated case in an adult two weeks in bed, another week sitting up or getting used to mild exercise, and all heavy work—such as lifting weights—forbidden for two months or more, is the best course to lay down.

Note on the one hand that even in the best subjects firm healing of the tissues cannot possibly occur in less than fourteen to twenty-one days, and therefore the advice often given by enthusiasts to remove the skin-sutures and get the patient about within a week is not wise. Too long recumbency is also to be avoided—one writer even advocated that hernia patients should be kept in bed for two months after operation to ensure a firm scar—but this would be an intolerable tax on hospital

accommodation, it would be quite unnecessary, and in most instances would involve permanent loss of the man's employment.

In the case of young children, of course, this objection does not apply, and as it is a well-known fact that healing is often slower in them than in adults, it is well to exceed the fortnight in bed for them (especially if a large scrotal hernia has been operated on).¹ Women with big umbilical herniæ also require an extended period of rest before they are allowed to get about.

Should a Truss be worn after Radical Cure.

With very few exceptions the answer is certainly in the negative. But in the case of a large umbilical hernia in an adult an abdominal belt should be fitted before the patient resumes work—if well adjusted it cannot do harm. In the rare cases of *direct* inguinal hernia, especially if a double one in a patient with relaxed tissues, it is best to order a light truss to be worn.

After radical cure of femoral hernia McAdam Eccles recommends the invariable use of a truss. I have not found this necessary as a rule, and would limit it to the minority in which recurrence shows itself and to the more difficult cases of operation on large herniæ.

In many patients after the sutures and dressing have been removed it is well to make them apply a spica bandage of elastic-webbing material—two and a half inches wide—with a pad of wool under this over the scar of the operation wound. A couple of turns of this bandage, applied with just sufficient tightness and fixed with a safety pin, will give a feeling of support and cannot possibly do any harm (as a truss might). Its use may well be continued for a few weeks.

Warning as to the risk of Constipation.—As we know that straining at stool is one undoubted cause of

¹ This slowness of healing in infants and young children is sometimes illustrated after abdominal section, *e.g.* for intussusception, when the removal of sutures within fourteen days may cause the wound to burst open.

hernia it may seem superfluous to point out that it must be sedulously avoided after operation for radical cure. Constipation will be favoured by the light diet and confinement to bed, but apart from this laxatives—such as senna or liquid paraffin, etc.—should be taken if necessary for a long time after an operation for radical cure. One easy motion a day must be the rule.

THE RESULTS OF OPERATION FOR RADICAL CURE, AND OCCASIONAL COMPLICATIONS

The following relates chiefly to *inguinal* hernia, on which by far the majority of radical cure operations are performed.

Few surgical operations are entirely devoid of some risk, and we shall see that certain special complications may attend that for radical cure.

But the first question to be considered is how far is the operation successful in curing the patient of his hernia whilst enabling him to dispense with wearing a truss ?

Of course no absolute time limit for recurrence can be laid down. I have known it to take place ten years after the operation. The time and trouble that is required to seek out and examine over a hundred of one's patients after they have been lost sight of for several years, can only be realised by those who have attempted the task. Many of the statistics published have been vitiated by the report being made when the patient left the hospital, or a few weeks or months afterwards. This will not do, and I therefore prefer to base the verdict on a research personally carried out under stringent conditions. Each of the 109 patients was examined by another observer as well as myself. All the patients were hospital ones, and undoubtedly they afford a better test than those operated on in private, as it is in those who are engaged in hard manual labour—in stokers, soldiers, railway porters, and the like—that the result of our

procedure is best estimated. Moreover, certain conditions must be thoroughly applied, especially with regard to the length of time that has elapsed since the operation. Bassini, to whom surgeons are indebted for having shown the importance of opening up the inguinal canal in the great majority of cases, reported cures in no less than 96 per cent. But his limit of time—nine months or under—was certainly too short, and to some extent invalidates his statistics. I have taken as the shortest limit two years from the operation, but so many of my cases have been examined seven, eight, or even ten years afterwards that the average works out at about six years. This will probably be accepted as sufficient. If a man has engaged in his ordinary work for six years after the operation and shows not the smallest sign of recurrence the term "radical cure" may fairly be applied. Again, differing from some authorities, I reject the use of any truss after the operation, since the patient has submitted to it, as a rule, in order to dispense with the inconvenience of wearing one. In four or five of the cases included in my list the patient has of his own choice worn a truss at some time or other after the operation but not on account of recurrence. In all cases of umbilical hernia after operation an abdominal belt should be worn: in a few examples of inguinal hernia (especially the direct form) and of femoral hernia in elderly people a truss is ordered after the operation. But in the statistics that follow it will be understood that these conditions have been carefully observed: (1) that at least two years, and on an average from five to six years, have elapsed before the result is tested: (2) that no truss has been ordered to prevent recurrence, and that within about six weeks of the operation the patient has been directed to return to his work: (3) that the smallest tendency to bulge at the site of operation has been considered as a recurrence of the hernia: and (4) that any development of a hernia at another site has been recorded. The last point will be found to be of considerable importance.

though it is curiously omitted by nearly all the writers on the subject.

The Result of Operation for Radical Cure on Inguinal Hernia.—Formerly it was considered inadvisable to operate on hernial subjects (apart from strangulation) who were over forty years of age. But of late years this limit has been extended, and in my list six patients were fifty years old or over. The best results of all are certainly to be obtained on young children, but it happens that only four of the cases in my list were under the age of five years at the time of operation. The great majority were men between twenty and forty years of age. I have followed up 109 patients after operation on inguinal hernia with the limit of at least two years. In four of these the herniæ were double, making a total of 113. Thirteen were cases of strangulation (with five recurrences), and it seems fair to leave these out since several were patients of very advanced age, three being 55 years old, one 65 years, and one 74 years. Out of 100 cases primarily done for radical cure, eight of the herniæ have relapsed *in situ*; of these in five the recurrence was pronounced, one very slight, and two doubtful. Seven patients have since the operation developed an inguinal hernia on the opposite side, and one a femoral hernia. I must admit that this result, 8 per cent or less of true recurrence, is somewhat better than I had expected.

After all, the formation of a hernia elsewhere does not detract from the original operation being termed a radical cure. And if, judged from the most severe standpoint, the proportion of relapses is only from 6 to 10 per cent, the use of the words "radical cure" is thoroughly justified. The statistics of several surgeons relating to Bassini's method practically agree with my own. Thus Carlé and Nicoladoni found 6 per cent of relapses *in situ*, and Ceccopieri and Scarrone 7 per cent. One may be allowed some suspicion of the much more favourable results that are now and then brought forward. Thus

Lucas-Championnière claims to have had only 4 per cent of recurrence, but in one of his tables it will be noticed that only half the total number were followed up for more than two months! This fact, to my mind, renders valueless his statistics, since recurrence, if it does follow, usually occurs from nine to eighteen months after the operation. There is, of course, no infallible limit, and of the eight cases of recurrence in my list one developed two years, and two others three years, after the operation: until that time had elapsed the cure appeared to be perfect. Some of my cases were operated on thirty years ago, and there is no doubt that improved methods during this time have diminished the proportion of recurrence.¹ The majority of the herniæ in my list had been operated on by Bassini's method—with two recurrences, others by narrowing the canal in front—one recurrence, whilst in the earlier cases the sac had been ligatured high up without any attempt to narrow the canal—five recurrences. This appears to give conclusive proof that the latter method is not sufficient.

In further analysing the eight cases of "recurrence" it must be pointed out that the patient's word had to be taken alone in two, as no abnormal bulge could be detected when they were seen. It would perhaps have been right to omit these—leaving only six recurrences in 100. It should be noted that one patient with poorly developed muscles had a double hernia and recurrence followed operation on both sides, counting as two cases. Another, a case of double direct hernia, recurred on one side only after Bassini's operation had been done on both. A third patient proved to be so unruly and violent after the operation that recurrence of the hernia was only to be expected.

The conclusions to be drawn are: (1) If two years be taken as a test, if no truss has been worn, and if the

¹ For example recent statistics from the Mayo Clinic give only one per cent of recurrence, but I cannot ascertain what length of time had elapsed between the operations and the drawing up of the report.

patient has followed his occupation since the operation, recurrence of the hernia should not happen in more than 5 per cent of the cases; but (2) the development of a hernia *at another site* may be expected in about the same percentage, or rather more; (3) in all but the simplest cases in children the inguinal canal should be opened up during the operation and subsequently narrowed or strengthened by deep sutures.

COMPLICATIONS WHICH MAY FOLLOW THE OPERATION OF RADICAL CURE OF HERNIA

Strangulated hernia is here excluded, and reference is made chiefly to the inguinal variety. It will be convenient to deal first with some of the less important complications. Those due directly or indirectly to the anæsthetic are considered elsewhere (p. 40).

1. Especially after the operation for inguinal hernia, retention of urine is not unknown and may require the use of a catheter for a day or two.

2. Testicular complications—orchitis, hydrocele, or varicocele—should be rare provided room has been left for the cord, *i.e.* if the canal, and especially the external ring, has not been narrowed too vigorously.

It is held that they are especially apt to develop after Halsted's operation. Whenever a considerable part of the sac has been left below the canal it is likely to form a hydrocele subsequently, and a warning against incurring this risk has been given in describing the details of the operation.

Division of the vas deferens in dissecting out the sac is an unfortunate accident which has occurred especially when the surgeon is operating on a young subject, in whom the vas is very slender.

I suppose that few surgeons of large experience in dealing with hernia have not experienced this at least once: it offers a difficult problem as to what should be done. An attempt may be made to suture the divided

ends together, using the finest needle and thread obtainable, but whether continuity of the minute canal is ever obtained by this means or not must remain doubtful. It is worth trying. Anyhow there seems little reason for excision of the testis if this accident has occurred.

My friend, Mr. John Murray of the Middlesex Hospital, obtained a remarkable specimen from a patient who had been operated on for inguinal hernia long before by another surgeon. In this the vas had been divided and the two ends left apart. The testis had undergone extreme cystic degeneration.

Atrophy of the testis may result from rough handling of the ectopic organ when the surgeon is bringing it down into the scrotum, or from too free division of the vessels supplying it (Mignon's operation—see p. 98).

Thrombosis in the spermatic veins may result from some of the causes mentioned above, and is especially apt to occur during Bassini's operation if the cord is held up too vigorously or too long by the retractor or hooks.

Hæmatoma in the scrotum is an occasional complication, rarely of much importance.

3. Deep suppuration or sinus-formation from the use of silk as the material for buried sutures.

Emphasis has been laid on this complication elsewhere (p. 49), and although I have never used thick silk in these operations myself I have known so many cases in which it has given trouble that at the risk of wearying the reader with this topic an emphatic warning must again be given against the practice. If silk is used at all (and kangaroo tendon enables one to dispense with it), only the fine-calibre thread should be employed.

A sinus after a hernia operation is not only a nuisance to the patient, but it predisposes to recurrence of the hernia.

A silver filigree or silver wire may cause persistent suppuration which will only cease after removal by operation, perhaps a very troublesome procedure.

Apart from these, possibly causes of suppuration are

met with in operations for recurrent hernia, and ventral or umbilical hernia with recently inflamed skin.

It may be noted that few surgical operation wounds heal better, as a rule, than the vast majority of radical cures of hernia, and if proper care be taken as to asepsis and the choice of the deep sutures, in few is the risk of suppuration less. A surgeon may well do a hundred of these operations or more without meeting a single complication of any sort.

Very different was it in former times when the incision used to be prolonged into the scrotum !

4. Painful scar, or neuralgia below the site of operation. This is very exceptional, and may be due to inclusion of the ilio-inguinal nerve in one of the deep sutures. Due care to avoid this should always be employed, but probably inclusion of the nerve occurs not infrequently without trouble resulting.

5. Recurrence of the hernia, either *in situ* or at another orifice. This subject is fully discussed on page 81. Whilst the chances of recurrence after well planned and executed operation are but small, it is right to say that no method gives an infallible guarantee, and that it may happen as late as ten years or more afterwards.

We have now to note one or two grave accidents that may follow the operation.

6. Septicæmia or severe sepsis. This danger has of course to be guarded against in all major operations, and in spite of the immense improvements of late years unfortunate accidents of the kind still occasionally occur.

For example, a surgeon, taking apparently all orthodox precautions, operated on three hernia patients in one afternoon. All three developed symptoms of acute septic poisoning, and two cases ended fatally. What was the cause of such an extraordinary catastrophe ? Was it due to catgut ?

I have personally lost one case after radical cure from pyæmia. The explanation here was found in the fact that the man had an undiscovered stricture of the urethra

with secondary infection of the kidneys. Another possible source of danger is oral sepsis, with which so large a number of patients are affected when they apply for treatment for hernia or other conditions.

The necessity for thorough and systematic overhauling of the patient's health and habits before advising radical cure is obvious (see p. 34), but considering the very great number of cases submitted to it, and the strain of hospital work, it is no wonder that needless risk is now and then incurred—sometimes with regrettable issue.

7. Post-operative thrombosis and embolism (chiefly of lung or brain).

Attention has lately been drawn to this in a valuable paper by Mr. Lockhart-Mummery, and by the subsequent debate.¹

Sudden death from thrombosis blocking the pulmonary artery may occur in a patient convalescing after a hernia operation, say at the end of a fortnight. It is a tragedy that cannot be foreseen or avoided. Out of 47 deaths from pulmonary embolism reported from the Mayo Clinic 5 followed hernia operations (against 10 after operations on the vagina and uterus).²

McAdam Eccles (in the debate mentioned above) narrated one case of his own—death occurring suddenly a fortnight after the hernia operation. I have had one similar misfortune, in a young healthy man whose hernia wound had healed normally, and who was about to return home. The post-mortem revealed no trace of sepsis.

Besides these mysterious and tragical cases there are many more in which after hernia operations a mild form of localised pneumonia ensues, and is probably due to a thrombus being carried into the pulmonary circulation.

¹ Section of Surgery, *Royal Soc. Med.*, March 1922, where reference to the literature will be found.

² The figures of the Mayo Clinic were derived from 63,573 operations, so that the proportion of fatal embolism was less than 1 in 1000. But non-fatal pulmonary complications, some due to thrombosis, are much more common after operations (1·2 per cent at the Mayo Clinic).

Lockhart-Mummery believes such cases (after various operations) are ten times as numerous as the fatal ones—but this is problematical.

It is fairly certain that the anæsthetic is often wrongly accused. In the present state of our knowledge it is useless to dogmatise as to prevention—one can only say that too tight bandaging should be avoided, that the patient should be encouraged to change his position in bed from time to time after undergoing an operation, and that the Trendelenburg posture (very rarely indicated in hernia operations) is considered to have risk in favouring subsequent thrombosis.

CHAPTER IV

CONGENITAL INGUINAL HERNIA. IMPERFECT DESCENT OF THE TESTIS. DIRECT INGUINAL HERNIA. INGUINAL HERNIA IN THE FEMALE.

CONGENITAL HERNIA

THIS subject is so closely connected with the descent of the testis that a brief account of the latter is necessary. It will be based to a considerable extent on the researches of the late Mr. Curling, a predecessor of mine on the staff of the London Hospital.

The testis, developed in common with the kidney from the Wolffian body, lies at first in the loin in front of the psoas muscle. By the twelfth week of intra-uterine life it possesses a tubular structure as well as a fibrous covering (the tunica albuginea), and a serous coat derived from the peritoneum. The latter also comes to form a posterior fold, the mesorchium, between the two layers of which its vascular supply reaches the testicle. "Originally upper and lower bands fix the Wolffian body: the upper passing to the diaphragm may be named the diaphragmatic: the lower running down towards the groin contains muscular fibres and constitutes the future gubernaculum testis (or round ligament of the uterus in the female)." ¹

Note that the upper band is of comparatively little interest to the surgeon, but the gubernaculum testis is all-important in relation both to the descent of the testis and to congenital hernia.

¹ Quain's *Anatomy*.

The gubernaculum (first described by John Hunter in 1786) is composed partly of fibrous and cellular tissue, but mainly of striped muscle fibre. *Above* it is attached to (1) the lower poles of testis and epididymis, (2) the commencement of the vas deferens, and (3) to the adjacent peritoneum. *Below* it has three distinct origins—(1) internally from the pubis and rectus muscle sheath, (2) externally from Poupart's ligament, whilst (3) a mesial slip (the most important as regards hernia) is connected with what will be later the bottom of the scrotum. Of course the latter is not pushed down until the testis enters it.

Reference to Fig. 43 will make this description clear. I have by dissection of fœtuses confirmed Curling's description of the three bands of muscle. Curling notes also that a number of muscle fibres are reflected from the internal oblique on the front of the gubernaculum. As the latter contracts and shortens the testis is drawn away from the kidney towards the internal ring (fifth or sixth month), usually reaching the ring in the seventh month. During the eighth month it traverses the inguinal canal, both preceded and accompanied by the processus vaginalis. In cases of arrest of the testis in the canal, the peritoneal tube may be found reaching several inches lower down into the scrotum: this, however, is not always the case.¹ Obviously a scrotal hernia may therefore occur whilst the testis is still retained, in or close to the inguinal canal.

Now when the testis has passed through the external ring the inner and outer bands of the gubernaculum—attached respectively to the pubes and to Poupart's ligament—can obviously do nothing more to favour the descent of this organ. They have shortened to their utmost extent, and the final descent into the scrotum

¹ I placed in the London Hospital Museum an interesting specimen from a man who died of peritonitis in connection with an ommental hernia. On *both* sides the testis was retained at the lower end of the canal, and on both sides an open hernial sac descended into the scrotum.

depends solely on contraction of the middle band. During the ninth month this final stage is completed so that both testes should be in the scrotum at birth. In 30 per cent of male infants at birth, however, one or both testes are not completely descended, though in half this number they will be down in the next month (Wrisberg). Delayed descent is somewhat more common on the left than the right side (Marshall, Wrisberg, Curling, Godard); this is curious, as congenital hernia is generally admitted to be most frequent on the right side—due to the closure of the processus vaginalis being later on this side.

Another point about the gubernaculum muscle—the outer and inner bands become transformed into the looping fibres of the cremaster, connected with the internal oblique muscle and having attachments to pubes and Poupart's ligament. In rodents the muscle at the time of rut draws the testes down into the scrotum, after it they are again retracted into the abdomen. Something of the same sort is occasionally seen in man (Sappey).

The middle band, if it has completed its function, loses its muscular structure, but remains as a fibrous connection between the scrotum and lower part of testis, tunica vaginalis, and epididymis: these remains can, as a rule, be easily demonstrated during the operation of castration.

It is important to remember that the gubernaculum is a somewhat variable structure. If all three bands are deficient the testis must remain within the abdomen, if the middle band is absent or poorly developed the testis cannot be drawn down into the scrotum. A slight alteration in the lower attachment of the middle band accounts for the rare cases in which the testis is drawn into the perineum or the front of the thigh, after traversing the inguinal canal. I have never met with an instance of the testis having come through the femoral ring, nor is there a single museum specimen to show it, and scepticism on this point seems justified; but Curling¹

¹ Curling, *On Diseases of the Testicle*, p. 57. P. Berger states that in ten cases or so altogether ectopia testis has been observed in the

adduces five cases, two under his own observation, so that its possible occurrence must be admitted.

The attachment of gubernacular fibres to the peritoneum close to the testis (when in the abdomen) explains how a tube of the former (the vaginal or funicular process) can precede the actual descent of the testis, and how the funicular process may be drawn into the scrotum although the testis lags behind. If abnormally attached to the cæcum this viscus may be drawn down into the scrotum with the testis, etc.

In the preceding account of the so-called "descent of the testis," which from the usual position of the foetus in utero is of course an *ascent*, stress has been laid on the active contractile power of the gubernaculum, and especially of its muscular fibres. This view is entirely opposed to the teaching of many who, following Cleland,¹ deny any such function to the gubernaculum. Thus Quain writes, "It cannot be said that the shortening of the plica gubernatrix is the cause of the descent of the testis, and much less (as has been held by some) the muscular fibres of the gubernacular cord are the agents which effect this change of position."

It is important to clear our ideas on this subject, which has an intimate bearing on many cases of inguinal hernia, and I therefore submit that—

1. All the points with regard to the muscular bands of the gubernaculum which Curling demonstrated in 1841 and Robin confirmed in 1849 can be proved by dissection.

2. Those who deny the active power of the guber-

femoral canal, but he gives no particulars or references. One can only imagine that the testis has been drawn through the femoral ring by an abnormal attachment of the gubernaculum in infancy when the gland is very small (but the femoral ring then is still smaller). How can one account for such an extraordinary course for the gubernacular fibres? The subject is "wrapped in mystery." Of course it is easy to explain the testis coming through the *inguinal canal* and then being guided into Scarpa's triangle, somewhere near the femoral canal, but this is another matter.

¹ Cleland, *Mechanism of the Gubernaculum Testis*.

naculum are left without a reasonable explanation alike of the normal passage of the testis into the scrotum, and of the various abnormalities that may occur. Some of the suggestions that have been made are almost absurd. The following case which I had the good fortune to observe illustrates in a remarkable way the power of the gubernaculum, and it is probably unique in its nature and clinical features :

A boy, aged 12, came under care for a hydrocele of the left side which seemed to communicate with the peritoneal cavity but could not be emptied into the latter. The hydrocele was bilocular, and when it was opened a firm rounded band was seen to be attached to the body of the testis, which lay at the bottom of the scrotum and was atrophic. The band was moniliform, the enlargements having a purple colour, whilst the rest of the band was white and elastic. Traction on it proved that it passed upwards the whole length of the inguinal canal so as nearly to block a narrow aperture into the abdominal cavity. The band was quite free from the spermatic cord, and it evidently was connected with some viscus high up in the abdomen. I decided to follow it up through an incision in the left linea semilunaris, and found it amongst the intestines, reaching all the way up to the left pouch of the diaphragm. Here it was thicker but still rounded, and it finally ended at the hilum of the spleen, being about 12 in. in length. Its upper attachment was secured by a ligature, and both band and atrophied testis were then removed. The two wounds in the groin and abdominal wall were then closed and a radical cure obtained. Section of the purple nodules in the band under the microscope confirmed the diagnosis that they were splenic in origin.

It is obvious that whatever view be taken of the origin of so strange a band, the connection between the spleen and left testis must have been formed at an early period of intra-uterine life. Presumably it developed when the testis lay close to the kidney, and as the former descended the band was gradually elongated and drawn down into the scrotum. It is, however, remarkable that the testis was not hindered in its descent, and the fact that it ever reached the scrotum

testifies to the considerable tractile power exerted by the gubernaculum.¹

Three causes have been assigned for arrested "descent" of the testis: (1) a deficient or weak gubernaculum; (2) adhesions of the organ within the abdomen; and (3) a too narrow external ring. Of these, probably the first is much the most important. There is little evidence that adhesions due to intra-uterine peritonitis hinder the descent of the testis. As to the external ring forming the obstacle in some cases there can be no doubt, and M. Tillaux lays much stress upon the fact that in inguino-interstitial hernia, with the testis retained in the canal, the external ring may be a mere slit only giving passage to the ilio-inguinal nerve.²

The surgeon who operates on undescended testis, with or without hernia, will be inclined to give yet another cause—abnormal shortness of the cord, either of its blood-vessels, of the vas deferens, or of both. But here it is very difficult to decide between cause and effect. Has the testis failed to reach the scrotum because the cord and its peritoneal investment (plica gubernatrix) would not stretch sufficiently, or is the shortness of the spermatic cord due to the fact that the testis has always remained too high up?

The subject of ectopia testis or arrested descent is a large one, and we are here only concerned with its practical bearing on hernia operations. Before considering the varieties of hernia met with in this connection a few points require notice.

1. The retained or ectopic testis is usually provided with a lax investment of peritoneum, the mesorchium or meso-testis, which allows of considerable mobility of the organ. Hence its special liability to become twisted (torsion of the testis), a condition readily mistaken for strangulated hernia. This mobility also accounts, as I

¹ Hutchinson, J., *Proc. of Surgical Section, Royal Soc. of Medicine*, vol. vi. p. 224 (1913).

² Tillaux, *Anatomic topographique*, p. 632.

shall urge later, for the development of some cases of interstitial or interparietal hernia (see p. 115).

2. The peritoneal tube or investment of an ectopic testis continues open above, no matter what the age of the patient. This of course does not imply that a hernia always results, but its likely occurrence forms a sound

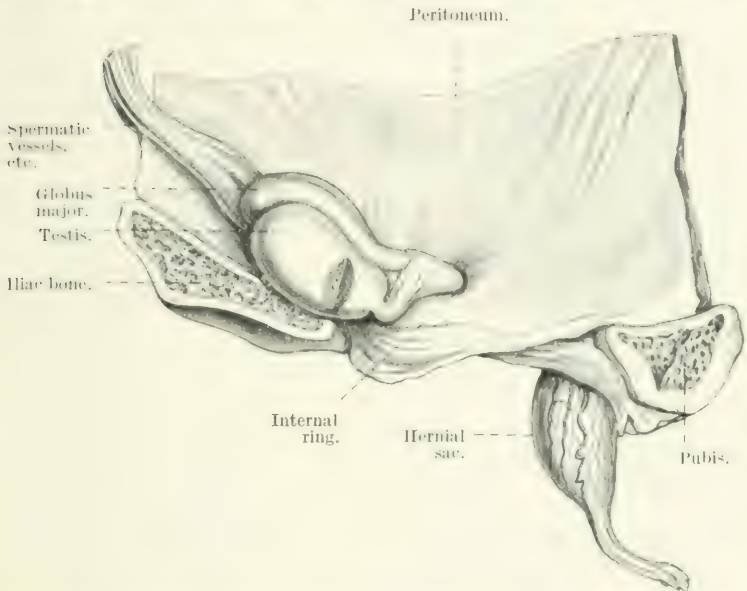


FIG. 19. Imperfect descent of the testis on left side; the specimen is seen from the peritoneal aspect. The testis lies well above the internal ring, but a hernial pouch extends down into the scrotum. The globus minor and vas deferens looped down into the inguinal canal.

reason for operating in early life, when there is a fair chance of bringing down the retained organ to its normal place in the scrotum, as well as of closing a sac which invites the descent of intestine into it.

I have occasionally found, in operating on retained testis, that the processus vaginalis was shut off above, but this is quite exceptional.

3. The gubernaculum testis often draws down the peritoneal tube to a lower level than the retained testis,

hence a hernia may reach even to the bottom of the scrotum although the testis is still in the canal (see p. 50). We can explain this by remembering the upper attachments of the gubernaculum, and from the same cause

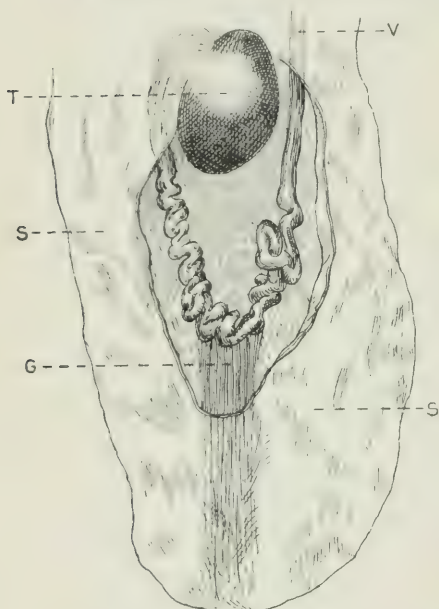


FIG. 20.—Testis (T) retained in the inguinal canal, below which a large hernial sac (SS) descended into the scrotum. In the posterior wall of this sac the vas deferens (V) looped down for several inches, attached to this loop are seen the remains of gubernacular fibres (G). A portion of the hernia sac has been removed to show the loop. (Original dissection.)

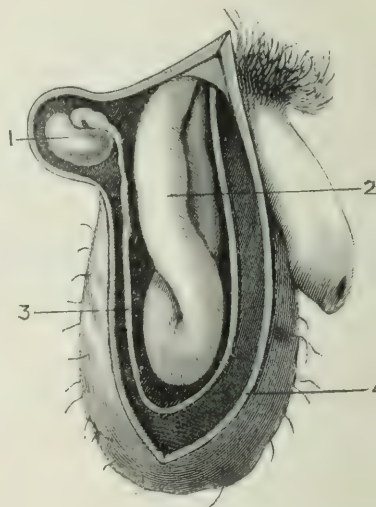


FIG. 21.—Partially descended testis (1) with an inguinal hernia descending to the bottom of the scrotum (4). (2) Small intestine in sac. (3) The vas deferens looping down nearly to the bottom of the sac. (Ter-rillon.)

occasionally the vas deferens loops down for some inches below the ectopic testis (see Figs. 20 and 21).

4. The retained testis if successfully brought down into place will probably develop into a normal-sized and functional organ. If it remains in the canal, or is pushed

back into the iliac fossa by operation (as some surgeons have wrongly advised), or if it has never descended into the canal, it tends to atrophy early. Such retained testes in adult life are usually found to be small, flaccid, and not secreting healthy spermatozoa. Further, there is still reason to believe (in spite of arguments and statistics which throw doubt on this) that retained testes are specially liable to become the site of malignant tumours.

From these considerations, and from the risk of torsion occurring in a retained testis, we may safely infer (1) that in operating on such cases the testis should be brought down and fixed by suture as low as possible; (2) that if the testis cannot be *brought below the external ring* probably the best course is to excise it. If the inguinal canal be closed whilst the testis is left within the abdomen, there is risk of later complications which may endanger life, whilst an organ that is of small value has been preserved.

To these rules exceptions must arise, and surgical opinion is not unanimous on the subject. To my mind the chief difficulty arises when *both* testes are retained, when the operation is being performed on an adolescent or adult, and when it is found to be impracticable to bring *either* organ down. The surgeon in such a case may well hesitate to perform complete castration, remembering the importance of the internal secretion of the testes, and also the possibility of their forming healthy spermatozoa for some years at least.

The Treatment of Hernia complicated by Imperfect Descent of the Testis.—It has already been noted that whether the testis is retained in the canal, or lies just below it, its peritoneal investment is very rarely shut off above, and often descends towards the scrotum for some distance. Hence a hernia may develop at any moment, and this forms a strong reason for operation, with the double object of bringing down the ectopic organ and of preventing hernia in the future. Especially is this indicated if any symptoms such as inguinal pain, sickness, etc., can be referred to the condition.

As to the best age for operation opinions differ, and it is not easy to lay down a rule. Some advise waiting until the boy is ten or twelve years old or even till puberty, but the reason for this course is not obvious. If the testis has not descended by the fourth or fifth year it is hardly likely to do so later.

In passing it may be mentioned that Professor J. Wood advocated the use of a horseshoe-pad truss when the testis could be persuaded to emerge outside the external ring, but experience has convinced me that this is both uncomfortable for the patient to wear and quite ineffective. The earlier the operation is performed the greater is the chance of getting the ectopic testis down to its normal position; as years go on the cord becomes less extensile.

The Operation.—The inguinal canal being thoroughly opened up, the testis is drawn down gently as far as it will come and the peritoneal sac investing the cord above it carefully peeled off. Extreme care is needed in this manœuvre, as the peritoneum is so thin that it will readily tear. Once it is detached it is ligatured and pushed back, and the testis and cord below are cleared of every trace of adhesion. In many cases this complete isolation alone will enable the organ to be brought down. If not, the spermatic vessels (anterior bundle of veins and the main artery) may be ligatured and cut across. M. Mignon, who first advocated this, has had many followers, and it may be admitted that the division of the vessels often, but not always, allows the testis to be brought down a good deal further. It must, however, be remembered that thereby the main blood supply of the testis is cut off, and, as I have had personal experience, it may later undergo complete atrophy.¹ It is of no use

¹ It is apt to be forgotten that the spermatic artery runs down embedded in the centre of the anterior bundle of veins, hence division of the latter will leave only the "deferential artery" to carry blood to the testis. It is true that in operating on varicocele in adults the spermatic artery is ligatured with these veins, and that atrophy of the testis rarely supervenes. But this risk in young subjects may well be greater.

bringing down the testis if it is to waste away! However, this is not an invariable result of division of the main vessels, and "Mignon's operation" may be justified, though it is to be avoided if possible.

Let us suppose the testis freed of all adhesions and brought well below the external ring. The operator's finger clears a pouch in the scrotum for the reception of the organ and then, from the skin surface, passes a fine tendon or silk ligature upwards into the pouch, where it is again threaded on a curved needle and made to take hold of the testis itself and its tunica vaginalis. This is done by carefully stitching it through the tunica albuginea (it is absolutely essential to get a hold thus on the lower pole of the testis itself). This end of the thread is then passed through the scrotum a few millimetres from the aperture of entrance. We have then a loop of ligature, both ends emerging through the scrotum, the centre fixed to the testis: traction on this draws the organ as low as it will come. Before knotting the ends together the *skin only* between them is cautiously incised, so that when the knot is made it will be subcutaneous. Boracic powder is dusted over this minute wound, which needs no suture. The inguinal canal is then sewn up, finally the skin incision, and a dressing bandaged on. The latter need not include the scrotal region.

Throughout the operation the testis should be touched with either fingers or instruments as little as possible: in fact, except when passing the fixation suture through the tunica albuginea there is no need to do so. The reason for this care in handling the organ is the risk of "traumatic orchitis."

Variations in the Operation.—With the view of overcoming the pull of the cord Mr. Burghard and Sir Watson Cheyne advise that the fixation or traction suture should have both ends left long and attached to a small wire cage. Of course the effect of this can only be kept up for a few days.

The late Mr. Keetley devised the ingenious plan of

fixing the testis to a small raw surface made on the inner side of the thigh. This involved a bridge of union between scrotum and thigh, which might be obliterated at a later date.

In the very rare cases of testis *in perineo*, due not to failure of the gubernaculum but to a misplaced origin of its middle band, the operation would include division of the remains of this, freeing the testis completely and fixing it in the scrotal pouch as described. My experience has led to the belief that it is better, if the opposite organ is normal, not to attempt this, but to excise the misplaced perineal testicle. (See Plate II.)

Results.—It is exceptional for the testis to be brought down to its normal level, and for a time some puckering of the scrotum will probably remain. I have succeeded in tracing a good many cases for some years after the operation, and found that the testis remained where it had been placed in the majority; moreover, it was ascertained in several that the organ had increased in size with the growth of the patient. The results were very encouraging, especially as the risk of hernia or of torsion of the testis had been removed; more than this cannot fairly be said. It would be of much interest to obtain a full and trustworthy report on a large number of such cases, when the patient had been operated on in childhood and had *grown to full adult age*. At present I do not think any such record has been published.

So far we have been considering the cases of partial or arrested descent of the testis with persistence of the vaginal or funicular process. Such are frequently met with, but much more common is another failure in development, when the testis has reached the scrotum but the process of peritoneum remains unclosed.

CONGENITAL HERNIA—THE PROCESSUS VAGINALIS

The essential feature of congenital hernia, which, however, is often only ascertained to exist when an opera-

PLATE II.



PERINEAL TESTIS.

From an infant in whom the right testis was normally descended into the scrotum (R.), the left one after coming down the inguinal canal had been drawn by the median band of gubernaculum into the perineum, where it was fixed just in front of the anus and close to the tuber ischii, forming the lump (T.). The left scrotal sac (L.) is seen to be empty. In such a case excision of the misplaced organ forms the best treatment.

tion for radical cure is being performed, is that the processus vaginalis remains open all the way down. Hence if intestine or omentum form the constituents of the congenital hernia, they may lie in direct contact with, or even wrap round, the greater part of the circumference of the testis.

The obliteration of the tube of peritoneum, except where it forms the tunica vaginalis, is of much interest in development, and is especially met with in man and the higher apes. It is now well known that the funicular process—due to the lower end only being shut off, the upper part of the tube persisting—frequently persists throughout childhood and even adult life; also that hydrocele of the cord is a distension of part of the tube which has been shut off above and below.

When does the upper part of the vaginal process normally close? In a comparatively small number of infants it may be shut off at birth: at this date in only about 1 in 10 is the tube closed on both sides. During the next few months, in the great majority the processus disappears as a potential tube, though a fine fibrous prolongation often persists, a “vestigial remains.” The left processus vaginalis is usually the first to close; corresponding with this fact all observers are agreed on the greater frequency of congenital hernia on the *right side*. The above statement differs materially from that given by an anatomical authority, namely, that both vaginal processes “are generally closed a short time before birth” (Quain); and an older writer on hernia (Liston) was very wide of the mark when he stated that “the vaginal process is closed at its neck in almost every instance *long before birth*.”

If the vaginal process remains open and fluid collects in it a congenital hydrocele is produced: this may sometimes be cured by the constant wearing of a truss. In the same way, if a true hernia has developed, obliteration of the upper part of the process is often secured by truss pressure, but the truss must be worn day and night for

a long period of time (at least three years).¹ Each case must be judged on its merits, and the capacity of the child's mother to carry out instructions, as well as the wishes of the parents as to operation, have considerable weight in the matter.

Certainly there has been an increasing tendency of late years to resort to operation, whatever the age of the patient may be, and therefore to dispense with a long trial of a truss.

The Operation.—Many surgeons do not open up the canal, and most dispense with any attempt to narrow it; the essential thing is to isolate the sac from the cord high up and to ligature it firmly. The difficulty lies in dissecting off the sac, which may be exceedingly thin and adhering closely to the spermatic vessels and vas, which often project forwards into it, or are spread out around. The higher one goes, *i.e.* the nearer the internal ring, the more easy is the detachment of the sac, hence I believe it is best to open up the short canal. By patient dissection with toothed forceps and fine blunt dissector it is always possible to separate the sac from the constituents of the cord at some point. When once this has been effected the further detachment presents little difficulty. Note—the vas deferens in young subjects is a very slender structure, *readily divided if the knife be used during the separation of the sac*. Great care must be taken to avoid this accident. The isolated sac is now divided about an inch above the testis and the lower end sutured up to form the shut-off tunica vaginalis. A continuous suture of fine catgut answers the purpose well. The upper end of the sac is now ligatured as high as possible, the superfluous part cut off, and the stump treated in one of the ways described: *i.e.* it may simply be left loose, be anchored

¹ Mr. McAdam Eccles calls attention to the care needed as to the infant's diet during the attempt to cure the hernia by truss pressure—especially to the avoidance of food which produces flatulence. This is no easy matter! Of course if phimosis is present circumcision should be done; again, constipation must be guarded against.

behind the abdominal muscles, or twisted and brought through a small aperture in them (see p. 63).

If the canal has been opened up it will now have to be repaired by sutures: and where the hernia has been of large size I have always braced up the canal by one or more tendon sutures drawing the conjoined muscles down in front of the cord (see p. 58) as in hernia of adult life.

DIRECT INGUINAL HERNIA

In a direct inguinal hernia the protrusion occurs between the deep epigastric artery and the outer border of the rectus muscle, *i.e.* through the area known as Hesselbach's triangle.

If one looks at the back of the anterior abdominal wall above Poupart's ligament in an adult body, especially if the peritoneum be slightly stretched in the upward direction, it will often be possible to make out two folds running upwards and a little inwards. The outer of the two is the epigastric one covering the artery and vein: the inner (usually the most pronounced) is produced by the umbilical artery, now degenerated into a fibrous cord. A fossa can often be detected between these two; it is here that direct hernia commences,¹ a short distance from the fossa corresponding to the internal inguinal ring.

Note that here the transversalis fascia is usually strong and that immediately in front of it is the "conjoined tendon." For these two anatomical reasons the direct hernia increases slowly: it has a broad neck in comparison with the rest of the sac, and it comes straight forward rather than downwards. It is rare to meet with a direct hernia which has travelled far into the scrotum.

¹ A third fossa is often described on the inner side of the hypogastric fold, and an attempt made to divide direct hernia into two varieties thereby. But it is doubtful whether direct hernia ever starts on the inner side of the hypogastric fold, and if it does the point has not the smallest practical importance, and can therefore be ignored.

There is a striking tendency in direct inguinal hernia, if it bulges beyond the external ring, to split up the constituents of the spermatic cord, which are stretched over it. I have met with the vas deferens lying right in front of a direct hernia, and there is obviously special risk of this structure being wounded during operation.

A question of some interest arises: What is the relation of the conjoined tendon or muscles to the sac? It is usually stated that the hernia either spreads or stretches the tendon over it, thus making it one of the coverings of the sac, or else works underneath the muscles and to the outer side of the tendon. If the former were the case the hernia could only be very small in size; it is not likely that the muscles and tendon would give enough to form an extensive bulge. My belief, based on a considerable number of operations on this form of hernia, is that it almost always takes the second course. In other words, if a direct hernia is large enough to justify operation the conjoined muscles will be found immediately above the neck of the sac and not forming one of its coverings.

What has given rise to the erroneous statement that they are spread out over the sac so as to form one of its coverings? I think it is that the thick transversalis fascia has sometimes been mistaken for the conjoined tendon. P. Berger, whose accuracy and precision in all that relates to hernia are remarkable, for once leaves the matter in doubt; for he writes: "It is probable that the feeble development or the atrophy of the transversalis muscle and of the conjoined tendon is the cause which most favours this form of hernia, which is of more frequent occurrence than most writers lead one to believe."

Causation and Frequency, etc., of Direct Inguinal Hernia.—The theory that a congenital process of peritoneum is ever present in this form of hernia may, I think, be rejected; direct hernia is always acquired, usually in late adult life. Its subjects are, as a rule, men over forty. Loss of muscular tone and recurring

intra-abdominal strain (due to constipation, stricture of the urethra, enlarged prostate, etc.) are probably to blame.

Direct inguinal hernia is often symmetrical.

Its frequency, compared with indirect hernia, is admittedly small, though very difficult to determine exactly, for the following reason. An indirect or oblique inguinal hernia after a time tends to push the epigastric vessels more and more inwards. Thus the internal ring comes to lie immediately behind the external one. In examining such a hernia after reduction of its contents and invagination of the tissues by the finger, the latter goes, as it were, straight back into the abdomen: the outer edge of the rectus muscle is felt immediately on the inner side: the diagnosis of direct inguinal hernia is naturally made. The fine plates of hernia in Quain's *Atlas of the Arteries* well explain the above-mentioned points.

It is impossible to detect (before operation) the pulsation of the deep epigastric artery with the finger, and hence to decide exactly between the two forms of hernia—direct and indirect. Often it has happened that the direct variety has been diagnosed before operation, to be disproved when the latter was performed. It should not be forgotten that both varieties may co-exist in the same patient, though rarely.¹

The exact diagnosis is not of great practical importance, apart from operative details. It may be noted that owing to the wide opening of the neck of the sac, etc., in direct hernia strangulation seldom occurs;² the hernia is simply an encumbrance which leads the patient to seek palliative treatment. Reduction is usually easy in these cases, the intestine dropping back when the patient lies down.

Treatment of Direct Inguinal Hernia.—If non-

¹ It is a point of interest that direct inguinal hernia appears to be practically unknown in the female sex, though Scarpa, the great anatomist, referred to its possible occurrence.

² "I have never seen a strangulated direct inguinal hernia" (Masson, *Mayo Clinic*, 1920, p. 1074).

operative treatment be decided on a double truss should always be worn.

Some surgeons hold that direct inguinal hernia is not suitable for the operation for radical cure, as recurrence is so apt to take place after it. However, I have seen several cases in which success was obtained, and believe that it is well worth while to make the attempt, provided the patient is a suitable one, *i.e.* he is in good general health, not too fat, and free from any contributory cause such as stricture of the urethra, etc.¹

The Operation.—The inguinal canal being opened up through the usual oblique incision, it will be found that the cremaster muscle and fascia do not form an even layer over the hernia as in the case of the ordinary oblique hernia: on the other hand, the constituents of the cord are probably spread out in front of it. Blunt dissection is used to detach them, and they are retracted to the side. The thick covering of transversalis fascia, with probably a layer of subperitoneal fat, is then divided and the sac exposed and isolated all round. It will probably be unnecessary to open the sac, which should be drawn forwards as much as possible and grasped by pressure forceps. The fingers of the left hand hold the neck of the sac, and by their means it is made certain that the sac is empty. It should be added that blunt dissection has already established the position of the deep epigastric vessels *to the outer side* of the sac-neck, and has made evident and cleared the lower border of the conjoined muscles above it. The sac is now twisted and trans-fixed by a long mounted needle threaded with kangaroo tendon. This is done of course just in front of the fingers of the left hand which secure the neck. A Staffordshire knot is firmly tied after the needle has been withdrawn; both ends of the tendon ligature are left long. The superfluous sac is then excised with scissors, *making sure that a stump is left well secured by*

¹ Recurrence after operation on direct inguinal hernia is estimated at 10 to 15 per cent (Coley, Downes, Davis).

the ligature. This stump is anchored behind the rectus muscle by means of the mounted needle by which the long ends of the ligature are passed, guided by the left index finger. It may be thought there is some risk of piercing the deep epigastric artery with the needle, and the operator may on this account prefer simply to cut the ends of the ligature short and not attempt to anchor the sac pedicle. There is, however, no risk if the finger clears a space to the *inner side* of the hernial orifice before the needle is passed. The most important stage of the operation is now reached, consisting in sewing down the conjoined muscle border to Poupart's ligament behind the spermatic cord with several interrupted sutures. This is done with the cord raised from its bed on a retractor.

Finally, the front of the inguinal canal is reconstituted and the wound closed.

When direct inguinal hernia is bilateral both sides should be operated on at the same time. In the after-treatment especial care should be taken to avoid constipation or any form of straining effort for a long time after the operation.

Whether a light double truss should be worn or not must be left to the discretion of the operator; certainly there is more reason for its use than after radical cure of the ordinary oblique inguinal hernia.

INGUINAL HERNIA IN THE FEMALE SEX

A considerable proportion, but not the majority, of these cases occur in childhood—say before the age of fifteen. Probably all of these are of congenital origin, due to persistence of the canal of Nuck. This tube of peritoneum, in close relation with the round ligament, is analogous with the processus vaginalis of the male, but it has of course no possible utility. Nor has it any obvious reason from the developmental point of view. The ovary is occasionally drawn down into the groin, with or without

the Fallopian tube, but congenital hernia of the ovary is of very rare occurrence indeed compared with a persistent canal of Nuck. To explain the latter we must of course refer to the traction of a few fibres of the gubernaculum which would be traced below into the labium majus—corresponding in the male to the middle band (see p. 90) attached to the scrotum. The two labia majora of course correspond to a divided scrotum. Still the puzzle remains, why is a canal of Nuck ever developed at all? It looks as though Nature had originally intended the ovaries to lie outside the pelvis like the testes, and had made provision therefor as regards the peritoneum, but had changed her mind and left them as intra-pelvic organs—greatly to the advantage of the gynecological profession. Dissection of newly-born female infants proves that in about 1 in 4 (25 per cent) a patent canal of Nuck exists along the inguinal passage extending towards the labium majus. Hence it is a very common abnormality, though in most cases it becomes obliterated in the first year or so. Closure of its upper (abdominal) end alone and not of the whole canal may give rise later to hydrocele of the canal. Such a hydrocele may be either a single and simple cyst containing clear fluid, or a multilocular swelling, perhaps with purple intra-cystic projections—a very curious condition to discover during operation. I have operated on one exactly like a row of ripe purple grapes. Hernia into a congenital sac in young females is fairly common on both sides, the right having the preponderance, and in 1 in 4 will be found to be bilateral. It is of course far more frequent than femoral hernia at this age, the latter being extremely rare.

Inguinal hernia in the female appearing first after puberty may still be of congenital origin, *i.e.* into a persistent canal of Nuck, but we may fairly regard the cases developing in adult or late adult life as being acquired: the pouch of peritoneum being pushed down from above as the result of increased intra-abdominal

pressure from pregnancy, constipation, chest trouble, etc. In other words, the internal ring in adult females, as in males, is a point of weak resistance, like the femoral. It is curious that in women acquired inguinal hernia is always of the *indirect* form, entering the canal to the outer side of the deep epigastric artery. At any rate a direct hernia in a woman is practically unknown.

It is often said that femoral hernia is more common than inguinal in women: this idea has arisen from the much greater proportion of strangulated femoral hernia in this sex. But if careful statistics are taken of the non-strangulated cases we find that the inguinal form predominates.

Thus P. Berger from examination of 2160 females (over fifteen years of age) affected with hernia found nearly 1000 to have inguinal against 800 femoral. In five recent years, 1917 to 1921 inclusive, at the London Hospital 220 female patients were admitted for inguinal hernia compared with 144 for femoral hernia (in both cases not strangulated). But if the strangulated cases are added it would seem that femoral hernia considerably preponderated in women over inguinal, a curious paradox which it is difficult to explain.

Amongst girls inguinal hernia sometimes coincides with umbilical, both being due to weakness at the site of congenital apertures, or to persistent peritoneal tubes. Amongst women affected with inguinal hernia we find that three out of every four have been pregnant, and usually attribute their rupture to this predisposing cause: bronchitis comes second. For the reason just mentioned varicose veins in the labia may be met with attending the hernia, their cause being identical.

A hernial sac originating in a persistent canal of Nuck will be found on operation to adhere very closely to the round ligament, the scattered muscular bands which represent the male cremaster, and the surrounding fascia. Such a sac may therefore be difficult to dissect out. There is another peculiarity sometimes found: one or

more valvular folds at the neck, which represent a natural attempt at closure.

The Contents of the Sac.—As in the male sex, inguinal hernia in women usually contains small intestine or omentum, or both. The large intestine is rarely met with. The ovary and Fallopian tube are occasionally present in the sac. Of course if the herniated ovary is healthy it should be returned into the abdomen, but in a good many it has become cystic or otherwise degenerated, and should then be excised. In one case I removed a diseased ovary from an inguinal hernia in a child under three years of age.

The most strange occupant of an inguinal hernia in a woman ever recorded was a floating kidney! This was returned by the operator into the abdomen, but the propriety of this course may be questioned.¹

Risk of Strangulation.—Although not so high as in femoral hernia the risk is very considerable, to judge from the following figures. In the last five years at the London Hospital 220 female patients were admitted for radical cure of inguinal hernia against 40 for strangulation, the latter showing a proportion of 15 per cent of the total. Comparing this with similar admissions of male patients, we find 140 cases of strangulation against 1040 for radical cure, *i.e.* less than 12 per cent of the total. And if strangulation has come on the death-rate is much higher in women with inguinal hernia than in men; this fact is, I think, not realised.

At the London Hospital, of the former no less than 35 per cent died compared with about 15 per cent in male cases of strangulated inguinal hernia, *i.e.* more than double the death-rate after operation. To what is this high mortality to be ascribed? The operation in itself is simpler in women than in men, but if it has to be done during pregnancy there are of course special risks, and certainly in women the dread of an operation may lead to it being postponed till too late.

¹ Deipser, *Centralblatt für Chir.*, 1887, p. 724.

Operative Treatment.—With very very few exceptions radical cure should be resorted to in all cases. The patient should be urged to submit to an operation which is practically free from danger, the result of which is almost certain, and which will protect her not only from the many troubles associated with wearing a truss, but also from the grave risk that (as we have seen) attends strangulation. As to the details it is unnecessary to say much here, for apart from the fact that there is no spermatic cord to be considered (the round ligament may be disregarded), the description of Halsted's operation applies (see p. 74). As already stated, in congenital cases tough adhesions around the sac may render its dissection out tedious or difficult, and during it the lower part of the sac may be torn—this is easily got over.

It is advisable to remove the whole sac if possible: by strong traction it can be drawn out of the labium majus without any necessity for prolonging the incision below the external ring. As in males, the isolation of the sac should always be begun high up—by the internal ring—here it is easy. I recommend either twisting the sac and bringing it through a fresh opening (method (c), p. 61) or anchoring the ligatured pedicle behind the muscles on the level of the anterior superior spine (the routine method described on p. 57). Either answers perfectly: perhaps the first is most suitable for girls or young women in whom the sac is small and probably thin, the latter for more bulky pedicles.

The canal should be obliterated by a series of kangaroo-tendon sutures, with care to avoid the ilio-inguinal nerve.

NOTE.—In dissecting out the fundus of the sac, special care should be taken to secure every vessel first with Wells' forceps, later with fine silk ligature, otherwise a troublesome hæmatoma may form in the labium. Moreover, firm pressure on the dressing should be secured by the elastic-webbing bandage: this will prevent oozing. But it is in the vascular labium that post-operative hæmorrhage is apt to occur, and here pressure cannot well be applied: care in ligaturing should avoid any risk of this complication.

Instances of a double sac have been described (by Golding Bird, Luke, and others)—one sac being in the labium majus, the other either protruding up into the muscular wall of the abdomen, or into the femoral region—both sacs having a common opening above. My impression is that such cases are extremely rare, and very difficult to explain.

Results.—No truss should, in most cases, be worn after the operation; if the latter has been done efficiently there is no fear of recurrence. There is, however, the question of pregnancy to be considered; obviously it is not advisable to operate during it unless a suspicion of strangulation arises—then one must. Looking at the subject generally one is inclined to say that no case of strangulated inguinal hernia should ever occur in women if only doctors would realise the safety and certainty of the operation for radical cure.

CHAPTER V

INTERSTITIAL HERNIA. UMBILICAL HERNIA. VENTRAL HERNIA

INTERSTITIAL AND INTERPARIETAL HERNIA

ONE of the most puzzling and difficult forms of hernia to operate on is that where a double or bilocular sac exists, one pouch extending between the layers of the abdominal wall, the other passing down the canal. In about 80 per cent of these cases the hernia is congenital, and in a considerable proportion the testis remains undescended and is found within the hernial sac (see Figs. 22 and 23).

The first point is then an abnormality in the descent of the testis, the second an excavation or extension of the peritoneal sac surrounding the testis, which takes one of three directions. The first is upwards behind the conjoined muscles, but in front of the peritoneum—forming the properitoneal or intraparietal variety. Intestine getting into this sac will steadily distend it upwards until it forms a very large flattened lump, holding many coils of gut, and analogous to a similar hernia in the posterior abdominal parietes—that into the lesser sac through the foramen of Winslow. I believe few if any cases have been recorded in which the sac protruded upwards between the transversalis and internal oblique, but the second variety, that in which it bulges up between the external and internal oblique muscles (the interparietal sac), is almost as important as the properitoneal one. Finally, there is a third (extraparietal) form in

which an extension of the sac mounts up above Poupart's ligament between the external oblique and the superficial fascia. This is of less interest and importance than the other two forms, about which has grown a literature of formidable dimensions.¹

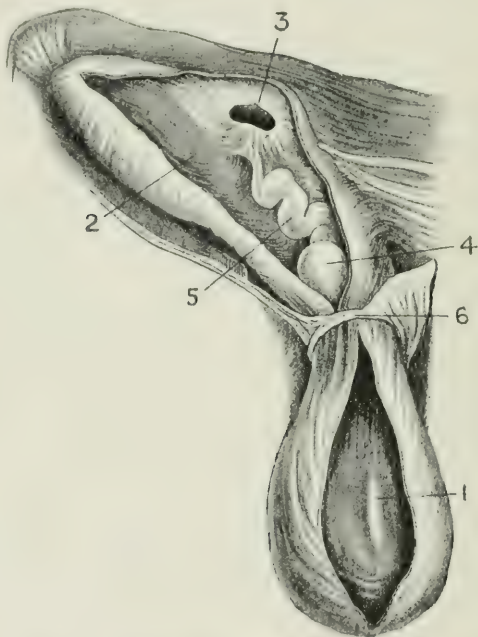


FIG. 22. Partially descended right testis (4) with lax mesorchium (5) and a large interstitial sac (2) between the peritoneum and the muscles. This sac extends as high as the anterior superior spine, it communicates through a small opening (3) with the general peritoneal cavity, and below the external ring (6) with an empty scrotal sac (1). (After Froriep.)

Besides the names given above, a number of others have been applied, with which it is unnecessary to trouble

¹ Amongst the papers and lectures on the subject are specially to be noted the following: Krönlein, *Archiv für klin. Chir.* vols. xix. and xxv.; Berger, in Duplay's *Traité de chirurgie*; Tillaux in his *Anatomie topographique*; Sir B. Moynihan, R.C.S. Lectures, pub. in *Brit. Med. Journal*, Feb. 24, 1900.

ourselves. The theories put forward to explain the formation of the inter- and intraparietal sac are also very numerous: a detailed list will be found in Moynihan's elaborate account.¹

It is not of very much importance whether the sac extends up between the external and internal oblique, or between the muscles and the transversalis fascia: in both forms a narrow external ring and retention of the testis above this in the inguinal canal are the most essential features, though not quite invariable. Thus in only ten out of fifty-nine cases was the testis said to be normally descended.

There must therefore be some causal relation—what is it? I venture to put forward a simple explanation which has hitherto escaped notice. When the testis is retained in the canal it is practically always found to be invested with a lax mesorchium, hence it is a mobile organ as proved by the occurrence of torsion of the testis. In such a case active muscular exertion, bending the body forwards, straining at stool, etc., will inevitably tend to push the mobile testis upwards or inwards. The looser the mesorchium the greater will be the range of mobility, and it is easy to see how a pouch of the processus vaginalis may thus be formed between or behind the muscles of the abdominal wall. Once the pouch has been formed intestine is likely to enter it, as the internal ring (ostium abdominale) is always patent, and a sac which at first had merely lodged the mobile testis may enlarge so as to contain many feet of intestine.

Such is, to my mind, the true explanation of a subject which has been obscured rather than enlightened by a number of more or less fantastic theories. That it accounts for many cases I am convinced. At the same time it should be noted that a double sac—one interstitial, the other inguinal—has been observed in the female sex.

The *diagnosis* of either interstitial (intermuscular) or propperitoneal hernia may be difficult, partly because

¹ *Loc. cit.*

they are of rare occurrence.¹ There is a flattened bulging mass opposite to and reaching above the inguinal canal, perhaps as high as the umbilicus (case recorded by Tillaux). There may also be a hernial bulge below the external ring, in most cases the testis cannot be detected on that side. If strangulation has come on, the signs of intestinal obstruction will coincide with pain and tension about the swelling, and probably severe abdominal shock. This form of hernia if strangulated has been attended with a high mortality, the operation to relieve it may be exceedingly difficult, and in any case a free incision of the abdominal wall is required. If the case is seen before strangulation has supervened, radical cure should be insisted on. If the retained testis is small and atrophic it should be excised, this will simplify the operation and give a more certain radical cure.

The *treatment* and other points relating to properitoneal hernia will be best illustrated by the following typical case which occurred in my practice, and by reference to Fig. 23.

A young man, aged 15, was admitted with severe symptoms of abdominal collapse, associated with a painful lump over the right iliac fossa. The history given was that the right testis had never descended, that four months ago a "rupture" had first appeared on this side, and that a doctor was supposed to have reduced it. A few hours before admission the lump became larger and very painful. There was no vomiting, but with the abdominal pain his pulse became rapid and weak, and his extremities very cold. The swelling lay immediately above Poupart's ligament, and a sulcus separated it from a less defined lump higher up (this proved to be caused by the extension upwards of the hernia behind the muscles). The right side of the scrotum was empty. The finger could not enter the inguinal canal. Operation was performed without

¹ A remarkable instance of this difficulty in diagnosis occurred in the case of a man with a swelling deeply placed in the groin. It was considered to be a new growth by more than one experienced surgeon, and suspected to be malignant in nature. Operation revealed it to be an interstitial hernia!

delay, a free incision through the external oblique aponeurosis exposed a thin sac which, on being opened, let out a great deal of clear yellow-brown fluid. The sac projected in two directions, down the canal, and under the conjoined muscles into the space between the transversalis fascia and the peritoneum. It contained the testis and a loop of small intestine nipped by a peritoneal fold at the internal ring. The deeply congested gut contrasted strongly in colour with the white

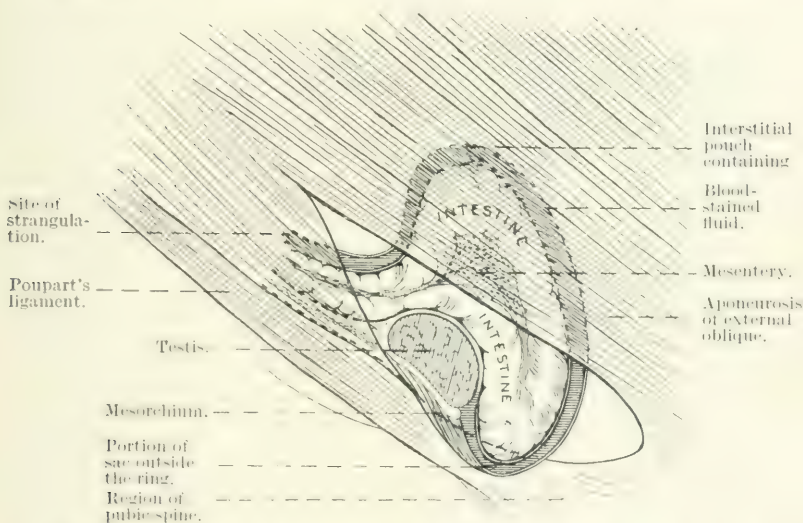


FIG. 23. — Interstitial or interparietal hernia, the testis being in the inguinal canal, surrounded by the loop of strangulated intestine. The site of strangulation was at the internal ring. Operation: recovery. The hernia was much larger than indicated by the diagram.

testis. The constriction having been divided the gut was returned and the sac carefully dissected away, including both pouches and the covering of the cord. In this manner the sac was isolated high up, twisted and ligatured with a Staffordshire knot, and was then removed. The testis, of fair size, could not be brought down beyond the pubic level. As it was probably functional it was left *in situ*, but it might have been better to excise it. Every measure was taken to diminish the shock, but as the operation had taken some time it was

thought well not to add to its severity by removing the testis.

Three kangaroo-tendon sutures brought the conjoined muscles down to Poupart's ligament, and the exterior wound in the external oblique was firmly closed with sutures of the same material. The patient made an excellent recovery.

Note in the preceding case that the retained testis had evidently been present in the canal, free to be moved by muscular contraction and to excavate a pouch under and within the conjoined muscles, for many years before any hernia entered the sac. Note also that the site of strangulation was at the internal ring. Tillaux¹ was probably in error in holding that the constricting agent in properitoneal hernia is the muscles arching over the neck of the internal pouch. That it may be so occasionally would appear from one of his cases, where, after the symptoms of strangulation had come on, more and more intestine seemed to enter the sac, in this, differing completely from the ordinary cases of strangulated hernia.

UMBILICAL HERNIA

At least three distinct varieties of umbilical hernia occur: (1) the congenital form or exomphalos, (2) the infantile form, and (3) the acquired umbilical hernia of adults. Of these the last is by far the most important as regards radical cure.

1. True congenital umbilical hernia develops during intra-uterine life, is, of course, present at birth, and is usually of large size, depending on failure of union of the anterior abdominal wall. In foetal life the rudimentary cæcum, commencement of ascending colon, and part of the small intestine lie outside the abdominal wall until the twelfth week; about this time they should retire within it, and the urachus and omphalo-mesenteric duct close. Persistence of the condition present at the

¹ Tillaux, *Anat. topograph.* pp. 663 and 665

end of the third month produces the congenital hernia, and the protruding viscera (having been merely covered by amnion) do not acquire a proper skin covering or sac, but only a thin transparent membrane through which the coils of intestine can be seen (Fig. 24). Needless to say, such a delicate sac is liable to rupture and to inflammation—if either of these complications has occurred, operation is practically hopeless.

As seen in the illustration the umbilical cord forms a thickening in the upper part of the membranous sac and requires to be carefully dealt with during the operation.

Comparison is often made between exomphalos and spina bifida, and in a sense it is a fair one, both conditions being due to failure of closure of the parietes respectively of abdominal wall and spinal canal.

There is also a striking resemblance in the membranous character of the sac in both cases.

But there is one important difference—attempts to cure a large spina bifida at or soon after birth always fail, and if in more favourable cases (the infant having survived

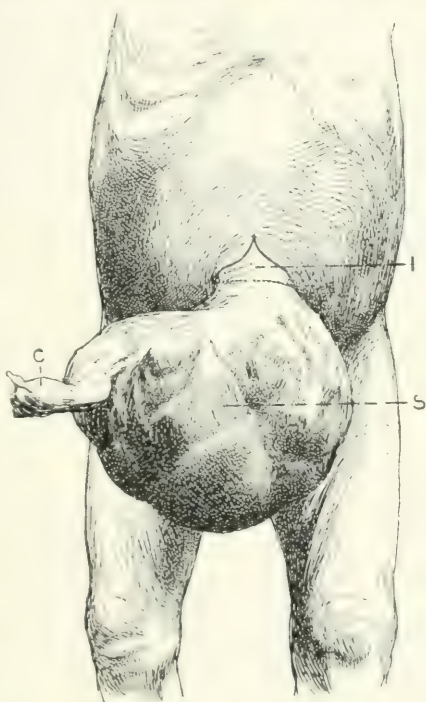


FIG. 24. True congenital umbilical hernia.

The sac (S) was so thin and membranous that the coils of intestine were clearly seen through it. C, The umbilical cord. I, incision for radical cure, which was performed with successful result.

for some time and the sac being fairly small) the surgeon succeeds *pro tem.*, hydrocephalus will ensue. In other words, operation at an early period is never really successful. Quite the reverse is true of exomphalos; operation if done very early may be completely successful, and if once healing has been obtained no future complication is to be feared. Of course the infant cannot survive long if the protruding intestines are allowed to remain outside the abdomen: it is surprising how easy it is to reduce them and to close the aperture in the abdominal wall. *Success depends on operating within a few hours of birth, and on rapidity in technique.*

Neither a general nor a local anæsthetic is usually required, a whiff or two of chloroform at most will keep the infant quiet. The opening is circumscribed by a somewhat racket-shaped incision (see Fig. 24) made through the edge of the normal skin, the false sac is wholly removed, the intestines bathed with warm saline and returned, the umbilical vein ligatured flush with the abdominal wall—the opening in the latter being raised by two blunt hooks, and its edges firmly united by silkworm gut. These sutures should be left in a fortnight or more.

Most writers in discussing the treatment of exomphalos are unduly pessimistic as to the result of operating, and some unwisely counsel delay (with treatment by antiseptic powders, etc., locally).

No one can have a large experience in operating on these exceptional cases, but my own limited one has been quite favourable. Two out of three cases of extreme exomphalos made a perfect recovery after operation, and a fourth case operated on by my friend Mr. A. E. Kennedy of Plaistow, was a remarkable success. In this last case there was not only exomphalos but a congenital obliteration of the lower part of the ileum. The strictured portion was excised and the ileum joined to the cæcum, the intestines were then returned and the abdominal walls brought together. The infant survived and grew up to be a healthy child. This case is possibly unique.

Not all cases of congenital umbilical hernia are of the form described—the process of closure may go on almost to completion, leaving, however, a small bulge in the centre of the cord. In this a single loop of intestine may be present and an extraordinary accident may happen—the midwife or doctor in tying and cutting off the umbilical cord *may cut right across the loop of gut*.

Specimens illustrating this disaster are contained in the museums of the Royal College of Surgeons and of the London Hospital. It will be understood that in these cases there is no large membranous sac, merely an abnormal fulness in the proximal part of the cord—hence the mistake.

Now and then a small congenital hernia becomes strangulated soon after birth: such a rare occurrence is very likely to escape detection, and hence the cases have usually proved fatal.

It may be noted that occasionally present in these small congenital herniæ is a fibrous cord connecting the mesentery inside the abdomen with the fundus, probably a vestigial remains of an omphalo-mesenteric artery. Traces of the vitelline duct may also persist.

2. The Infantile Form of Umbilical Hernia.—This very common variety of hernia in infants is due to a yielding of the umbilical cicatrix, due to strain from coughing or vomiting, etc. It appears some time after separation of the umbilical cord, is generally small, and is easily retained by the well-known method of strapping. In cases which persist a broad rubber belt, fastened by buckles, and having a rounded air-pad opposite the umbilicus, should be worn constantly. Spontaneous cure is then almost invariable, but now and then in children the rupture may require operation for radical cure. This is of the simplest nature: after return of any intestine the peritoneal opening is sewn up by a continuous catgut suture, in front of this the aponeurotic edges are sutured closely together with kangaroo tendon.

3. Umbilical Hernia of Adults.—This is by far the

most important of the three varieties, and its treatment often involves much difficulty. Its onset is rare before twenty-five years, and its preponderance in the female sex is shown by the figures of admission to the wards of the London Hospital during five recent years (1917 to 1921). 128 cases in all were admitted, of these 97 were in women, 31 in men. Increasing obesity is an important factor in its production, together with relaxation of the abdominal muscles from want of proper exercise; in women repeated pregnancies strongly favour its occurrence.

Once developed, an umbilical hernia of this kind is never cured by truss pressure, which moreover is specially difficult to maintain. The best form of truss consists in a concave circular pad of metal, covered with wash leather, kept in place by a steel spring passing round the trunk, and continued into a leather strap which fastens into a stud at the centre of the metal pad.¹

If the hernia is reducible, and the truss can be worn without discomfort, the patient and surgeon may prefer to continue with palliative treatment only. An effort should be made to diminish the accumulation of fat and to strengthen the abdominal muscles by restricted diet and by exercise. But it must be emphasised that radical cure in this early stage can now, owing to improved methods of operating, be done with excellent prospects.

If it is not performed the hernia will probably increase steadily in size, become irreducible owing to adhesions, produce much discomfort and digestive disturbance, until ultimately the following description applies:

The hernia is large, and possibly of enormous size; the patients are most frequently women past middle life. They are usually corpulent, and often excessively so; their tissues are flabby, their muscular development is feeble, their digestive organs are deranged, and they are not infrequently the subjects of embarrassed breathing. They make bad subjects for operation, and the

¹ McAdam Eccles, *On Hernia*, p. 184. In this work this well-known truss and a few other forms are illustrated.

unwieldy character of the huge and pendulous abdomen, which is shaken terribly by every cough, adds a difficulty to the after-treatment. The contents of these herniæ are usually in whole or in part irreducible. They generally contain omentum as well as bowel, and often present a loop of the transverse colon. Adhesions of an extensive and complex character may be anticipated, and the symptoms of strangulation are generally of a subacute character. The symptoms, indeed, are more allied to those that are associated with the so-called incarcerated or obstructed herniæ than to those of distinct strangulation. The coverings of the hernia are usually thinned, unhealthy, and discoloured; the mass is pendulous, and its general outline is lobulated.

It is especially in these large umbilical herniæ that the condition known as incarceration or obstruction is met with. By it is understood a stasis in the imprisoned bowel (generally the colon) without mechanical constriction of its blood supply. There should still be an impulse obtainable in the hernia on coughing. If the surgeon feels sure that strangulation has not come on, treatment other than operative may be justified, but if any doubt exists, by far the best plan is to resort at once to operation.

The medical treatment of obstructed hernia consists in giving repeated enemata, in applying moderate taxis, and in the use of laxatives. But do not delay too long; if the symptoms do not yield and the hernia does not decrease in size, then operate.

THE OPERATION FOR RADICAL CURE OF UMBILICAL HERNIA

Let us consider a typical case, a hernia the size of one's fist, irreducible for long, occurring in a stout middle-aged woman.

The surrounding skin is probably eczematous, and this condition must be cured before the operation is attempted.

The central region of the hernial protrusion above the true umbilicus is formed of thin atrophic skin, immediately beneath which lies the sac, probably there are omental adhesions to the latter. All this thin covering is to be removed, and the surgeon's incisions are placed well to the side. Two vertical cuts are made, convex laterally, which meet above and below some inches from the hernia, so that a lozenge-shaped area is circumscribed. These are carefully deepened on either side until the sac is isolated all round and the abdominal aponeurosis is cleared to the neck of the latter. Only then is the sac opened, a short distance in front of the margin of the ring. With scissors a circular incision is made through the peritoneum, which here is probably free from adhesions to the contents of the hernia. The latter can now be easily dealt with, intestine returned, and omentum ligatured and excised. Due caution must be paid to the omental pedicle, many ligatures may be required, each should include only a small portion, and each fine silk knot very securely tied. The ring itself may require to be incised at its upper margin before the hernial contents are returned.

The sac itself with the isolated area of skin and adherent omentum has been removed; the difficult problem remains to close the rounded or oval aperture so securely that recurrence of the hernia may be avoided. It is a good plan to prevent the intestine protruding by passing a swab held in sponge-forceps through the ring, whilst the latter is being dealt with. A broad ivory spatula or paper-cutter may be used instead. The ring in shape is either round or oval, it may be found easier to close horizontally or vertically; this can be determined by two blunt hooks inserted within its margins, first in one direction, then in the other. Whichever way shows least tension should be chosen.

The Mayo brothers have especially advocated the transverse method; whichever be adopted the following plan for closure is recommended. The idea is to get a very

firm transverse scar formed of aponeurosis, fascia, and peritoneum. The two recti muscles are not concerned in the scar, and it may be doubted whether this very friable muscle is of much use in any method, though some operators attach importance to it in suturing the edges of the opening. As noted, if the ring is sewn up *transversely* the muscle cannot be employed.

1. **The Reinforced Mattress-Suture Method.**—The sponge-holder is withdrawn, the wound in aponeurosis and peritoneum, etc., is made linear by

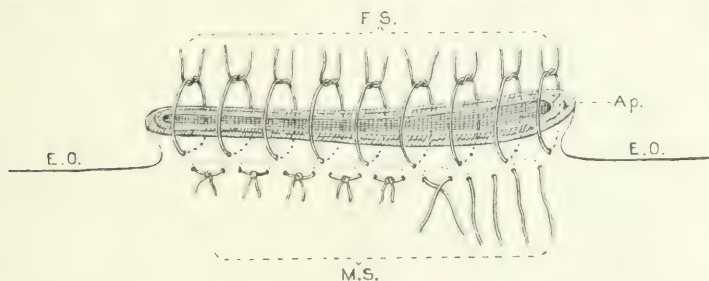


FIG. 25.--Author's method of closing aperture in radical cure of umbilical hernia by a double series of kangaroo-tendon sutures. Both rows traverse peritoneum, fascia, and aponeuroses of the abdominal wall (Ap. and E.O.). The sutures first inserted (M.S.) are mattress ones which pass right across at short intervals, most of these are shown knotted in the diagram, all are securely tied before inserting the second row (F.S.) which are represented loose—of course these also are firmly tied, thus turning in the edges of the wound. The sutures can hardly be placed too closely together in both rows. The object of the first row (M.S.) is to remove all tension in the other and to secure a firm scar.

traction, everted with two blunt hooks held by the assistant. A number of needles have been threaded with stout kangaroo tendon (many surgeons might prefer silk), with these a number of mattress-sutures are placed in series, close to each other from one end to the other of the wound (see Fig. 25). These when firmly knotted close the aperture completely, a second row of tendon sutures (more superficial) reinforce the first ones. This second row is formed of ordinary interrupted sutures.

I would emphasise the point that all the tissues available are included in both rows of sutures, that the first one takes off tension from the second, and that the individual sutures can hardly be placed too closely to each other. I believe that kangaroo tendon is the best material, and that with it there is no danger of sloughing of the included tissues. The tendon becomes organised into fibrous tissue forming the scar which it is our object

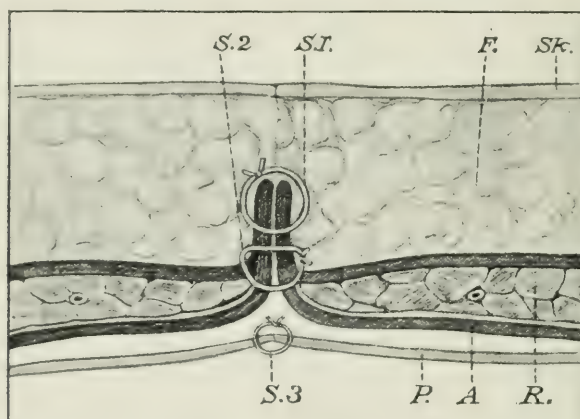


FIG. 26. Transverse section of umbilical region after radical cure of hernia by double row of buried tendon sutures passed through the aponeuroses (S.1 and S.2—the latter represents one of a series of mattress-sutures). S.3, suture in peritoneum (P) and transversalis fascia. A, Posterior layer of rectus (R) sheath. F, Thick layer of subcutaneous fat. Sk, The integument.

to create. I have used this method, which is more or less original, in many cases with excellent results. In unfavourable subjects with very large apertures no method is, however, infallible.

In suturing the skin-wound care must be taken that no dead spaces are left beneath it for blood-clot to collect in, and all bleeding vessels must be tied. A drainage tube is often advisable for forty-eight hours, of course it merely drains the subcutaneous area of the wound.

If a name were required for this form of operation, I would suggest the "reinforced mattress-suture method." Professor A. E. Barker brought forward one which is practically the opposite to that just described. He united the aponeurotic edges by a series of interrupted sutures, turned in (*i.e.* towards the abdominal cavity) the sutured line, and then by mattress-sutures through the aponeurosis drew the rectus sheath on either side together. Barker's method strongly resembles suture of intestine by a double row, the outer one by Lembert's stitches. I see no special advantage in it, and consider it more difficult to perform than the method I have described.¹

2. The Overlapping Aponeurosis Method.—We saw in (1) all the layers, except the recti muscles, treated in common during the suturing. An entirely different principle is adopted by many surgeons. The aperture in the peritoneum is first closed by a continuous suture of fine silk—with the serous layer usually the transversalis fascia is included.

Now with scissors the upper and lower edges of the oval aperture are incised for an inch or so—it thus becomes ellipsoid. The closed peritoneum is at the same time pushed by the surgeon's finger or dissector away from the aponeurosis all round the aperture. This will enable the overlapping stage to be carried out. Three or four strong sutures are inserted, taking a firm hold of the aponeurosis (and muscle edge) a few mm. from the inner border. It will be most convenient, as the operator is standing on the patient's right side, to take the left side of the wound for this purpose. These sutures need not be tied at present, nor are they placed close to each other, but roughly equidistant. By means of a mounted and curved needle the long ends of these sutures are

¹ It is only fair to state that Barker's and my own method were devised entirely independently, and that they differ in principle as well as in result. It will be found that the mattress-sutures, placed as I advocate, get a perfectly firm hold of *all the layers* and if well tied cannot become loose. In Barker's method the mattress-sutures have a precarious hold of the *outer layer* of aponeurosis only (see Fig. 27, p. 128).

brought through the tissues forming the right side of the aperture, from within outwards, and tied. It is best to start with the middle stitches, and to bring them through at least 1 inch from the hernial aperture, which has been converted by traction into a vertical slit.

Even to make the overlapping equal to 1 inch will mean considerable traction and tension after the sutures are tied. Hence they must be strong enough to stand the strain, and not likely to irritate and to work out subsequently. Catgut is useless for the purpose; Japanese silk (or perhaps silkworm gut) is the best.

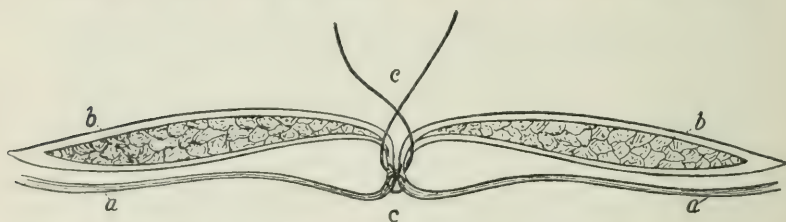


FIG. 27. Barker's method of radical cure of umbilical hernia; *aa*, peritoneum and transversalis fascia; *bb*, aponeurotic sheath of recti muscles, the latter are seen in section; *cc*, suture passed so as to turn in the aponeurosis towards the abdominal cavity. The suturing differs slightly from that described by Barker in the text. (From Cheyne and Burghard.)

The overlying flap of tissue (chiefly the two layers of aponeurosis) on the right side is now drawn over towards the left and sewn down as shown in Figs. 28 and 29.

Any redundant skin is cut away and the superficial wound closed with the caution mentioned in method (1).

Comment.—The overlapping method was especially advocated by Lucas-Championnière when dealing with inguinal hernia, though it obviously is of special value in the umbilical region; who first employed it would be difficult to ascertain.¹ Several modifications are obviously possible—the chief being to suture the posterior

¹ Papers describing this method will be found so far back as 1899—v. Piccoli in the *Centralblatt für Chir.* No. 2, and Bonomo in the *Poli-clinico*, Dec. 9.

aponeurotic layer separately and to make the front layer alone overlap.

The method is undoubtedly a good one, *provided it can be carried out*. But in some cases, after the peritoneum has been closed and detached, the attempt to make one edge overlap to any material extent will be found to create such tension that the sutures cannot be trusted to maintain. Of course by lateral incisions some distance away through the rectus sheath this tension can be slightly reduced, but this only adds two more weak spots in the abdominal wall.

3. C. Mayo of Rochester, U.S.A.,¹ pointed out that the tension of the parts round the umbilical aperture is greater in the transverse than the vertical direction, and introduced a method (which has been widely adopted) which includes a transverse

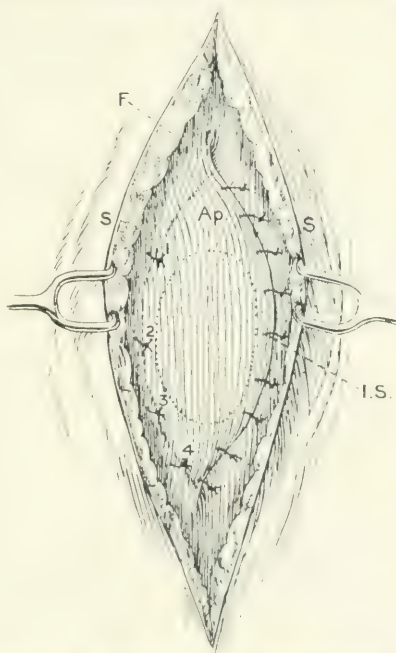


FIG. 28. Radical cure of umbilical or ventral hernia by method of overlapping. SS, the skin. F, subcutaneous tissue. The two rows of interrupted sutures fixing the overlapped layers of aponeurosis are shown; the oval dotted line in the centre between these two rows indicates the original size of the hernial aperture.

elliptical incision of skin and fascia. The neck of the sac is cut through, its contents returned into the abdomen, and the peritoneal aperture sewn up with catgut. By

¹ Mayo, *Journal of Amer. Med. Association*, July 25, 1903; also in Keen's *Surgery*, vol. iv. p. 89, and elsewhere.

means of two lateral incisions, starting from the ring and crossing over the fibres of the recti muscles and by blunt dissection beneath its sheath,

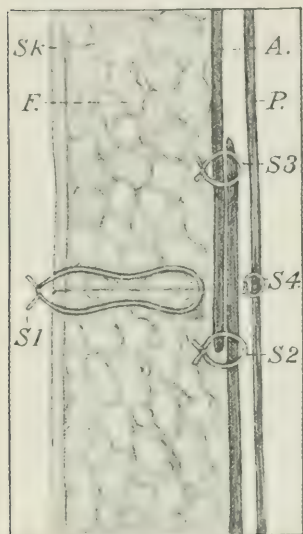


FIG. 29.—Radical cure of umbilical or ventral hernia by method of overlapping the aponeurotic edges. P, the peritoneum and transversalis fascia, closed by (S4) the deepest sutures. A, the aponeurosis, made to overlap by traction and secured thus by two rows of sutures, represented by (S2) and (S3). S1, one of a row of interrupted silkworm-gut sutures which dip deeply so as to bring together the whole thickness of the subcutaneous layer.

two flaps of the aponeurosis are raised. The lower one is drawn under the upper and secured by a number of interrupted sutures. The upper flap is then drawn down in front of the first, and also sutured (see Fig. 29).

Yet another way of arriving at a similar result is the "double sliding flap." In this two lateral flaps are mobilised by horizontal parallel incisions which pass just above and below the umbilical aperture. These two narrow flaps are raised and sutured together in the middle line, over these two larger flaps are drawn into apposition and their edges sutured.¹

It would be easy to add many varieties in method of closing the umbilical aperture described by Continental and English surgeons, but no useful purpose would be served thereby.

We have to aim in this region at securing a firm thick scar in place of the aperture,

and it is doubtful if this can be done by means of flaps carved out of the aponeurosis. Such flaps tend to stretch and atrophy, and so bulging is apt to recur at the site of

¹ F. G. Dubosc, *Surg., Gyn. and Obstetrics*, 1915, p. 771.

operation. Methods which on paper are ingenious and satisfactory enough prove disappointing in practice. For this reason I have put first the method of operating which utilises all the tissues round the umbilical aperture, believing that it is on the whole the best one. There only remain to be noticed one simple way of closing a small aperture, and finally the use of silver filigree.

4. Suturing Layer by Layer.—Few details can be required as to this. The edges of the ring being refreshed and brought together by traction, interrupted sutures are inserted in two or three layers. The peritoneum, fascia, and posterior layer of the aponeurosis may form the first, the recti muscles the second, and the anterior aponeurotic layer the third. For these buried sutures either silk or kangaroo tendon is employed, and in order to place them accurately traction and elevation of the wound-edges is secured by the assistant's blunt hooks at either end.

5. The Use of Silver Filigree.—If there is any form of hernia in which the insertion of a metal network might be justified it is the umbilical. In the groin (femoral and inguinal hernia), where flexion at the hips, etc., infallibly produces kinking of a rigid body like a sheet of filigree, such insertion must be ill-advised. But one can imagine that in the upper part of the abdominal wall, to block a large aperture, the use of silver filigree might be successful if it keeps in place without irritating the surrounding tissues. Of course the filigree must not be inserted unless a smooth surface of peritoneum can be obtained beneath it, otherwise dense adhesions to intestine and omentum are sure to result. The best layer for the filigree to lie in would be between the recti muscles and the deep aponeurosis, the latter being sutured with the peritoneum before the filigree is inserted, and a space cleared for the latter by the operator's hand.¹

I have never myself inserted silver filigree in any hernia case, but of course the value of any such procedure is not

¹ McGavin, *Brit. Med. Journ.*, Nov. 16, 1907.

affected by the views of one surgeon. This, however, is certain, that if it be really an improvement and not merely a novelty it will be tried at a large hospital and will come into increasing use.

How does the use of silver filigree in hernia cases stand this conclusive test ?

At one of the largest hospitals in Great Britain it was employed between October 1914 (about the time it was first strongly advocated) and June 1919 in eleven cases of umbilical and ventral hernia, or only two a year.¹ *After this date not a single filigree has been used in any hernia case during the last three years.* The only deduction to be drawn is that it has been found to be an unsatisfactory method.

Apart from the risk of the filigree shifting in position or "crumpling up," so to speak, there is a considerable chance of its irritating the tissues, of inflammation and suppuration around it leading to abscess and sinuses, requiring operation for its removal.

It should be noted, in opposition to the unfavourable judgment given above, that the insertion of silver filigree has had (and possibly still has) warm advocates. Amongst these were W. Bartlett, Phelps, and W. Meyer in America, Witzel and Göpel on the Continent, Douglas Drew and L. M'Gavin in this country. Considerable ingenuity has been spent in devising alternatives to the filigree. Plates of copper covered with platinum have one merit only—that of being expensive—celluloid, rubber, silver, and other materials have been tried with the same aim. In common with the filigree they all have the disadvantage of being badly tolerated foreign bodies, and their future is precarious in every way.²

¹ In the same period—five years—filigree was employed in three cases of inguinal, and one of femoral hernia—making fifteen in all, or an average of only three a year out of the many hundreds of hernia cases operated on annually in that hospital.

² An amusing plan was brought forward by Mr. R. W. Murray (*Brit. Med. Journ.*, June 16, 1906). In dealing with inguinal hernia he inserted a rubber pad with three apertures in it, a large one

After - Treatment and Results.— It is generally accepted that as soon as the wound is healed the patient should be fitted with a broad abdominal belt, fastening with buckles, and that special care should be taken as to fitting of this belt. Many surgeons advise that such a belt should always be worn afterwards, but I have found on tracing my old cases of operation that many of the patients chose to discard its use after a time for their ordinary clothing. No doubt the expense of renewal of a surgical belt is a considerable burden.

It is important to try to get the patient's corpulence down and to encourage exercise, but these precepts are difficult to carry out.

As to the final result, a considerable proportion of recurrence will be found in the next ten years after operation, especially in the poorer classes. *No method can prevent this*, but on the other hand, a permanent radical cure is obtained in a satisfactory proportion of the cases operated on, and even if recurrence happens it is easily controlled as a rule by a belt-truss, if taken early.

Hence the patients should be warned to come for inspection every six months or so if practicable.

The effective methods of radical cure have hardly come into use long enough to provide satisfactory statistics on a large scale.¹

In view of the dangers of strangulation, and the discomfort or misery caused by a large irreducible umbilical hernia, I would urge that every case that is at all hopeful should be submitted to operation for radical cure. Of course one must exclude patients with serious visceral disease—heart, kidney, or lung; perhaps also

for the spermatic cord, and two smaller ones "to permit the soft tissues to grow into them and so assist in retaining the pad in position." Mr. Murray's proposal *may* possibly have been intended as a burlesque on the use of filigree and other foreign bodies.

¹ Simmons in a recent paper (1921) puts the proportion of relapses after Mayo's overlapping method of operation as low as 10 per cent, after other methods as high as 45 per cent. A certain amount of caution is advisable in accepting these figures.

the very corpulent, though I have operated now and then on women who were "mountains of flesh."

Where there is a long gap between the recti and no localised hernia an operation is rarely to be thought of, and this condition must be controlled by a strong "abdominal belt."

We may note that operation for radical cure of a hernia may reveal unsuspected and graver disease: thus an inguinal operation may show tubercular peritonitis, and the umbilical occasionally forces the diagnosis of cancer within the abdomen, or of cirrhosis of the liver.

I operated on a woman, 40 years of age, for what was apparently a simple umbilical hernia. The escape of more fluid from the sac than was reasonable made me examine the condition of the liver—it was markedly cirrhotic. There had been nothing noticed before operation to point to this condition. Venous oozing from the wound occurred during the healing, a fact which pointed to congestion due to the cirrhosis. The prognosis would become grave in such a case, the outlook being entirely changed by the revelation of the hernia operation.

VENTRAL HERNIA

In even the most recent works on surgery the subject of ventral hernia is dismissed in a few paragraphs, and thus a misleading idea is given of the frequency of its occurrence and its importance to the surgeon.¹ Following the very great extension of abdominal operative work in the last thirty years has come, like a shadow, a corresponding increase in the prevalence of ventral hernia. War injuries added their quota. But the post-operative hernia is the important variety to consider now, and it is unfortunate that certain protrusions through

¹ For example, in J. P. Warbasse's *Surgical Treatment* (1919), an American book containing 3000 pages, ventral hernia occupies less than a page; the same is true of Spencer and Gask's *Practice of Surgery*. In H. J. Waring's *Operative Surgery* it is not even mentioned; and in the latest edition of Jacobson's great work it is dismissed in three lines!

or of the abdominal wall which are different in nature should have been included under the same heading. The following may be briefly noticed :—

1. Fatty herniæ, whether occurring at the umbilicus or near it, in the linea alba or semilunaris of either side, etc. These are discussed elsewhere (see p. 18).

2. Spontaneous divergence of the recti muscles, usually seen in women after repeated pregnancies, leads to a boat-shaped vertically placed protrusion, especially conspicuous as the patient rises from the recumbent position. The recti may be separated three inches or more. A hernial sac hardly exists in these cases, and surgical interference is rarely indicated. The use of a well-made abdominal elastic belt or corset, proper exercise, and care in diet are indispensable, though a cure is hardly to be expected. The condition is probably of congenital origin, though increasing in adult life.

3. Bulging forwards of the lower part of the abdomen, not simple overgrowth of fat, associated with prolapse of intestines and perhaps floating kidney (Glénard's disease or visceral proptosis).

Of course this condition does not constitute a true ventral hernia, but it is sometimes discussed with it. Mr. C. B. Lockwood attached importance to prolapse of the mesenteric attachment in producing hernia, and even attempted by operation to shorten or sling up the mesentery, with unfortunate results. Of late years a similar procedure has been practised on the transverse colon by a few surgeons.

True Ventral Hernia following operation or accidental wound of the abdominal wall.—In ordinary life the cases following punctured wound are of course rare, but important from their liability to be overlooked, the superficial wound having been sewn up and covered with a dressing, whilst a hernia of omentum or intestine in the deeper layer increases in size and may become strangulated. Many cases of this kind have occurred. There is no peritoneal sac in them.

Whenever there is the least doubt about a recent punctured wound of this kind it should be laid open, disinfected, the presence or absence of wound of the viscera ascertained and dealt with, finally the wound sutured up (layer by layer if possible).

The reader may be surprised to learn that during the last twenty years at the London Hospital no less than 500 cases of ventral hernia were admitted into the surgical wards, of which 450 required operation. The annual average during the first ten of these twenty years (1902 to 1911) was about half what it became in the second ten (1912 to 1921).¹ The vast majority of these herniæ were originally caused by some surgical operation—such as (in order of importance) (1) drainage of appendix abscess; (2) appendicectomy; (3) hysterectomy, ovariectomy, and operation for pyo-salpinx, etc.; (4) gastro-jejunostomy, and other operations in which an incision had been made in the upper part of the abdomen.

Ventral hernia is decidedly more common in female than in male subjects.

The following points may be noted about ventral hernia: (1) In no other form of hernia are adhesions between the intestine, etc., and the sac so readily formed, so extensive, and so constant; hence (2) it is usually impracticable to fit an efficient truss, and the operation for radical cure may present exceptional difficulty owing to these adhesions; (3) there is grave risk of strangulation occurring, and *the mortality attending operation for this is as high as in any other variety of hernia*²—except obturator, which is relatively so rare that it can be ignored; (4) a ventral hernia, apart from its dangers, tends to increase steadily in size, and causes more trouble

¹ In both 1912 and 1919 forty cases were admitted—in 1918 only seven; this was solely due to war conditions at the hospital. On the whole there was a steady increase during the twenty years.

² Amongst the 450 cases operated on there were approximately 40 of strangulation, of which 18 were fatal; some of the latter patients were moribund when taken to the theatre.

and disablement to its owner than almost any other form.

Prevention is better than cure. With more care in planning abdominal incisions, by limiting their extent to the strict minimum required, by avoiding the use of large or rigid drainage-tubes for appendix or other intra-abdominal abscess, above all in careful suture (layer by layer) of clean laparotomy wounds, by the use of kangaroo tendon for the deep sutures, we may and ought to diminish the risk of ventral hernia following our operations.

Undue haste in removing sutures, still more in not insisting on sufficient rest in bed after an abdominal operation, are both sometimes responsible.

After a "clean appendicectomy," for example, ventral hernia should be unknown, but every surgeon has met with instances to the contrary (probably not of his own manufacture).

Pathology of Ventral Hernia.—It would be tedious to enumerate all the complicated conditions that may be found within the sac of a ventral hernia. The sac itself is usually very thin and adherent to the "skin," a good deal of the latter being really stretched scar, especially if the original wound had suppurated. In the operation for radical cure all this poor covering is removed. The neck of the sac is represented by an oval or rounded opening in the external oblique, perhaps of considerable size, at or near the margin of which the deeper muscles usually adhere as well as the peritoneum.

If, as is so frequently the case, the hernia is in the cæcal region this viscus and the appendix (or a stump of the latter) may be in the sac. Omentum, nearly always adherent, is practically constant. The transverse colon and either jejunal or ileal coils are often present in the sac; adhesions, kinks and twists of the intestine are not infrequently met with.

If strangulated, gangrene of the gut seems peculiarly apt to occur. There is one condition occasionally met with in ventral hernia which is almost unknown in other

forms of rupture—namely, a localised deep abscess (in connection with an appendix stump, old pyo-salpinx, etc.).

The facts given above will explain to some extent the difficulties in the treatment of ventral hernia, both operative and by retentive apparatus.

Treatment.—In a very limited proportion of cases complete reduction by taxis can apparently be effected. I say apparently, for even in these it is probable that omental tags remain adherent to the fundus or neck of the sac. If the patient is a pregnant woman it is no doubt the best policy to have a well-made belt (with special pad over the hernial orifice) adjusted. In some others the patient may prefer the belt to an operation. But if the conditions are favourable to operation, and the patient not too stout or the subject of visceral disease, operation should be strongly advised. For whilst the hernial aperture is still small it is much easier to close with prospect of permanent cure than if one waits till it has greatly enlarged.

Note that in some advanced cases the operator has found it impossible to bring the muscles and aponeuroses together and has had to be content with some very imperfect substitute.

The Operation.—It is important to have the patient thoroughly prepared by some days' light diet, rest in bed, and use of aperients. Special care is required in rendering the skin aseptic and healthy (eczema below an overhanging ventral hernia is common and must be cured beforehand). Decayed teeth and oral sepsis must be attended to before operation is decided on. Stress is laid on such precautions because suppuration—even in these days—occurs after this particular operation under the most skilled and careful surgeons—and if it does occur it imperils the chance of cure, if not the patient's life. The mere fact that the hernia often originated in suppuration of the tissues, and that spores lie latent for years, may account for some of these cases of suppuration

after the second operation—but at least we must spare no efforts to avoid it.¹

It is often helpful to have the patient's pelvis slightly raised: some surgeons even prefer the full Trendelenburg position (which has certain very definite drawbacks and risks if used during a long operation—see p. 88).

An elliptical or lozenge-shaped incision is made so as to circumscribe all scar tissue and thinned skin—it is not in this layer that subsequent difficulty will be found in bringing together. Careful dissection outside the sac is carried all round until the external oblique and its orifice are made out.

The edge is raised and well undermined with the blunt dissector, the muscles below are then treated in the same way (it is rarely practicable to separate internal oblique and transversalis, we make one layer of the two). The sac has probably already been opened, in either case it is incised at some point where intestine and omentum are not adherent, and then the adhesions separated and the contents returned. These few words represent what may well be a delicate and tedious dissection, involving ligature and removal of omentum, excision of an adherent vermiform appendix, sometimes repair of wounded intestine, examination of the broad ligament and its contents in the female, etc., etc. Short-circuiting of intestine has been necessary sometimes, complete excision of a portion with end-to-end suture occasionally.

1. Suppose the contents got back—the edges of the opening held up well by blunt hooks or Wells' forceps—and the peritoneum and transversalis fascia carefully sutured—in one layer—by a continuous suture of fine kangaroo tendon or catgut ("fourteen or twenty-one day"). In passing this suture it may be a help to hold

¹ In the disinfection of the patient's skin I place unlimited faith in the thorough use of a solution:

Carbolic Acid, 1 ounce,
Perchloride of Mercurv, 5 grains,
Alcohol, 1 pint.

back intestine, etc., by a small gauze pad held by forceps, withdrawing both as the suture line is completed.

2. Two layers should, if possible, be obtained for suture outside the transversalis fascia, the two deep muscles together forming one, the external oblique aponeurosis the other. Both must be repaired by interrupted kangaroo-tendon sutures (some use fine silk), the stitches placed very near together, and the *suture line not corresponding in direction in the two layers*. This is as a rule easily managed by means of traction with blunt hooks.¹

3. Sometimes one can only make two layers with which to close the orifice—sometimes only one. In this case overlapping flaps, or the method described and figured in the section on umbilical hernia (p. 125) may well be employed.

Messrs. Mayo and others warmly advocate overlapping the oblique aponeurosis at least in all cases, but it may be doubted whether this is advisable or practicable, after well undermining the aponeurosis edges they should be drawn over one another to see; unless they overlap fairly easily, it is not wise to make them do so by extreme traction on the sutures—for obvious reasons. A moment's thought will show that the method described on p. 125 will make a firmer scar, and involve less tension on the sutures than extensive overlapping.

In the after-treatment note especially the importance of laxatives, the thorough rest for several weeks before resumption of work, the use of a surgical belt or other form of light support for many months, if not permanently.

Radical cure of ventral hernia has of late years become almost as important an operation (speaking of the numerical aspect) as that on femoral hernia; it is, as a

¹ Of course if the orifice is in the median line the anatomy is somewhat different and the two recti may form one layer. Note that the rectus muscle is very unsatisfactory for holding sutures, as it tears through with ease.

rule, much more difficult than the latter. Its subjects practically double those operated on for umbilical hernia.

It has been possible here only to give a brief sketch of the subject, sufficient, it is hoped, to emphasise the many complicated conditions met with, as well as the patience and surgical skill required for success.

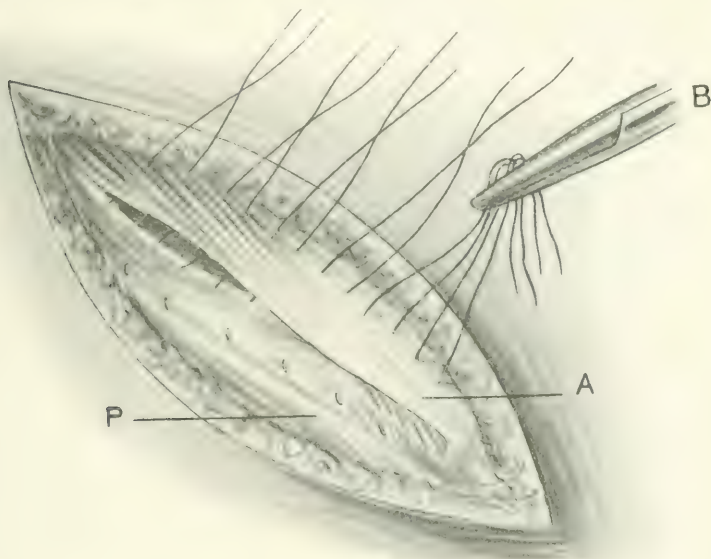


FIG. 30. Radical cure of ventral hernia, overlapping the aponeurosis edges by multiple sutures. A, anterior layer of external oblique under which P, the outer layer, is drawn by the sutures, some of which are held in the Wells' forceps B preparatory to tying each loop. A second row will suture down the edge of A to the outer surface of P. (From A. E. Barker's article on "Hernia" in Cheyne and Burghard's *Surgical Treatment*.)

No one should undertake the operation without considerable experience of abdominal work, knowledge of the conditions likely to be met with, and readiness to meet all emergencies.

It is hardly necessary to mention that the operation—apart from strangulation—has a distinct mortality of its

own, though it is unnecessary to attempt to give an exact percentage figure.¹

Much might be written on the use of silver filigree in the radical cure of ventral hernia, which was so energetically advocated in the years 1910-1917. During this time at the London Hospital filigree was inserted in a considerable number of operations, it had also to be removed in a considerable number. Since 1918, so far as I can ascertain, not a single case has been treated by the insertion of filigree by any member of a very large surgical staff. Such a verdict, after full experience of a much vaunted method, renders further comment unnecessary.

However, in a recent work,² the use of silver filigree is advocated in almost all forms of hernia, especially umbilical and ventral—almost to the exclusion of other methods. I see no reason to depart from the adverse opinion already expressed.

In a recent paper (*Brit. Med. Journal*, Nov. 25, 1922) Mr. H. S. Souttar endorses the objections given above to the introduction of silver filigree as well as to overlapping methods, and warmly advocates the use of mercurialised silk for “darning” a large hernial aperture. The material is prepared as described in a note on p. 49. It is not absorbed but becomes organised in the same manner as kangaroo tendon, which, however, Mr. Souttar does not mention. He states that the silk has the advantage of being inextensile.

¹ In five years' work at the London Hospital (1917-1921) there were 130 operations for non-strangulated ventral hernia with 4 deaths, but no importance is attached to these particular figures.

² Choyce and Beattie's *System of Surgery*, vol. ii, p. 580.

CHAPTER VI

FEMORAL HERNIA. OBTURATOR AND OTHER RARE FORMS OF HERNIA

FEMORAL HERNIA

CAUSES AND FREQUENCY, ETC.—In comparing femoral and inguinal herniæ as regards their ætiology there is one outstanding fact, that congenital conditions are of great importance in leading to inguinal hernia, they can almost be ignored with regard to femoral rupture. (See, however, the account of “Rare Varieties of Femoral Hernia” on p. 155.) Hence the frequency of inguinal hernia in early life, the great rarity of femoral (P. Berger found only 1 per cent of the latter developing before fifteen years of age).

The prevalence of femoral hernia increases from about twenty years to its maximum at about forty-five, on the whole it is about twice as common in females as in males. The chief reason for this is that the space between Poupart's ligament and the iliac bone is if anything larger in the female, whilst the ilio-psoas and blood-vessels are usually smaller and fill it up less, hence the femoral ring in the female offers a more definite weak spot.

The comparative frequency of femoral and inguinal herniæ in both sexes is variously given, but using a very large number of cases for the purpose (over 8000), one may safely conclude that inguinal is six times as common as femoral.

My own experience of hernia operations brings out a

striking fact with regard to this matter: the inguinal cases submitted to radical cure outnumbered the femoral ones by at least eight to one, whereas the operations for strangulation *were practically equal in number in the two varieties*. Now undoubtedly it is more difficult and irksome to keep up a femoral hernia by the use of a truss than an inguinal, and one would therefore expect patients with the former to resort to the operation quite as readily. It should, however, be noted that the impression prevails amongst doctors and the laity that it is a very difficult thing to cure a femoral hernia by operation. Generally speaking, if the operation is carefully performed this is not so. At any rate the proportions I have just given and the fact that my operations for strangulated femoral hernia considerably outnumbered those for simple radical cure prove the grave danger there is of strangulation occurring in this form, and the importance of advising radical cure to prevent this complication.

In men the proportion of inguinal to femoral hernia is at least twelve to one, in women the two are of nearly equal frequency, the inguinal preponderating. In both sexes the right side of the body is more often affected with femoral hernia than the left (roughly speaking, two to one), and in both we may find a femoral hernia coincident with an inguinal one on the same or the other side. Where multiple herniæ exist, especially in elderly subjects with lax abdominal walls and a tendency to prolapse of viscera (Glénard's disease) the outlook for radical cure is unfavourable, and operation had better be avoided.

THE ANATOMY, ETC., OF FEMORAL HERNIA

As Sir Henry Morris has well pointed out, too much elaboration has been devoted to describing, and still more to giving names to the structures in this region. We will therefore avoid any formal description, noting only such points as are of interest to the operator, and ignore most

of the anatomists' and surgeons' names which have unfortunately got attached to details in the anatomy of femoral hernia, some of these details being only made out after an artificial dissection of the parts.

1. The femoral ring and canal are normally quite small, a chink or gap transmitting lymphatic trunks and sometimes lodging a lymphatic gland. Although perhaps inflammation or an abscess starting in this gland *ought not* to be mistaken for a hernia, yet the error does occur sufficiently often to make it worthy of reference.

Three sides of the femoral ring are rigid, Poupart's ligament in front, the bone behind, and the concave edge of Gimbernat's ligament to the inner side. This ligament is all-important with regard to strangulation, it may be so sharp as to suggest a knife-edge, and the damage it may do to the small intestine in a few hours if strangulation rapidly occurs may well be imagined. It is well proved that perforation may occur within twelve hours of the onset of the symptoms.

The ring can only expand towards its outer side, and hence the great majority of femoral herniæ have quite a narrow neck. After the contents and sac have been returned within the abdomen the surgeon is, as a rule, struck with the smallness of the so-called ring, and supposing he has not divided or weakened Poupart's ligament during the operation (to my mind an unnecessary and bad procedure) he will find it easy to narrow the opening, if he thinks it advisable, by one or two sutures inserted in the manner to be described (see p. 161). Such operations as pegging down Poupart's ligament to the bone by Roux's staple need rarely, if ever, be contemplated. In fact, with regard to the radical cure of femoral hernia a recent writer states that "the opinion is gaining ground that no attempt should be made to close the femoral canal."¹

The narrow neck of a femoral hernia accounts for its occasional complete obliteration by adhesion, or plugging

¹ Thomson and Miles, *Manual of Surgery*, vol. ii, p. 453.

by a piece of omentum. Hence one meets sometimes with curious double sacs, one above the other, the lower being shut off and containing only fluid (or as I have seen, an amputated fringe of omentum), the upper one being of later protrusion and opening into the general abdominal

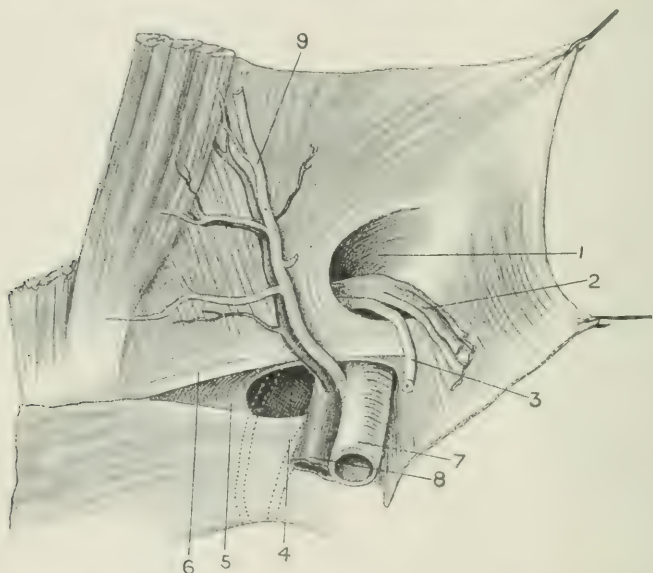


FIG. 31.—Deep surface of the right inguino-crural region, from which the peritoneum has been removed. (1) The internal inguinal ring, (2) the spermatic vessels with (3) the vas deferens. (4) The femoral ring with (5) Gimbernat's ligament at its inner boundary, above it is Poupart's ligament (6) and to its outer side the external iliac artery (7) and vein (8). (9) The deep epigastric artery; the dotted lines show the occasional obturator artery taking the "dangerous course" to the inner side of the femoral ring, and the obturator vein. (Cloquet.)

cavity. Hence also, if omentum plugs the ring, a hydrocele of the hernial sac may form (see p. 147) and attain a large size.

Above or behind Poupart's and Gimbernat's ligaments are two other arching structures, the conjoint tendon and the thickened edge of transversalis fascia known as

the deep crural arch—which are mentioned only because in one method of radical cure (see p. 162) the former structure is sutured down to the upper strong edge of the pectineal fascia or Cooper's ligament, a band lying along the ilio-pectineal line.

2. The short "femoral canal" ($\frac{1}{2}$ inch or so long)

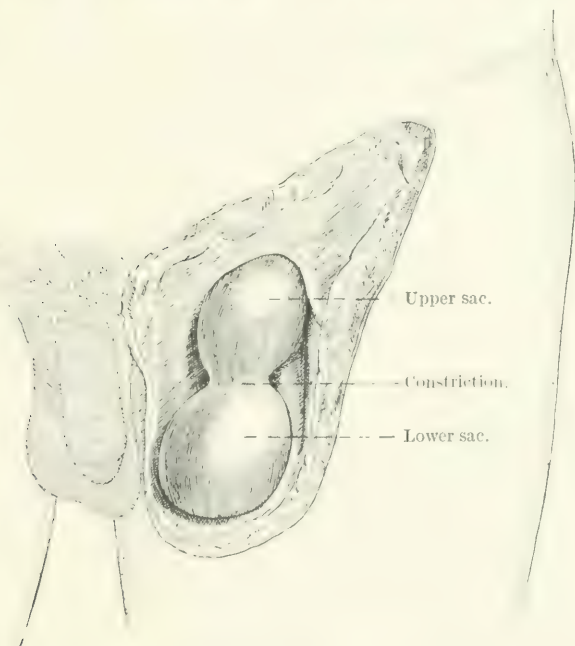


FIG. 32. Bilocular sac of a femoral hernia, distended with fluid.
The hour-glass swelling extends some way down the thigh.

has in front of it the superior cornu of the deep fascia, a structure readily made out in doing radical cure, and utilised sometimes for passing the sutures through. It is strange that not very long ago many authorities held that this cornu was the chief or only agent in producing strangulation of a femoral hernia, a view quite obsolete now. Immediately below this the hernia, if complete, bulges through the weak area in the deep fascia wrongly

styled the saphenous opening; here it often pushes in front of it one or more lymphatic glands which help to form its coverings. It can now readily expand, usually upwards, over Poupart's ligament. John Wood's comparison between the shape of such a hernia and the neck and bulb of a glass retort was a very apt one, as if taxis be applied to reduce a femoral hernia the comparison suggests the line in which pressure should be directed, first down, then back (through saphenous opening), then up (towards femoral ring). At the same time this is perhaps too precise, and it should be noted that taxis in a case of femoral hernia is only to be resorted to or justified if there are no signs—local or general—of strangulation. Many patients have lost their lives from the practitioner ignoring this rule—*never employ taxis if a suspicion of strangulation exists, but operate at once.*

3. The complete femoral hernia, as already noted, usually expands by mounting over Poupart's ligament and the external inguinal ring; in some cases the diagnosis then becomes difficult between the two forms of rupture. Two important guides, however, exist—the exact relation between the pubic spine and the deeper part or neck of the hernia, and the empty or occupied state of the inguinal canal as tested by the invaginating finger. The latter guide will chiefly be of use in the male sex.

It is worth while defining accurately the test of the pubic spine—if the latter is felt to the inner side of the hernial neck the rupture must be a femoral one, if the neck *can be displaced* to the inner side of the pubic spine it must be inguinal.

Another valuable test between a femoral and an inguinal hernia is the relative position of its neck to the line of Poupart's ligament—if the latter is above it the hernia must be femoral, and *vice versa*.

A third distinction lies in the direction of the pedicle or neck of the hernia; if femoral, it lies at the back of the swelling and can be tracked by the surgeon's fingers straight backwards below Poupart's ligament; if inguinal,

the pedicle is at the outer and upper side and can be traced upwards and outwards (this, however, does not apply to direct inguinal or long-standing indirect one).

Two other tests can only be tried if the hernia is completely reducible—in the case of a femoral one the invaginating finger detects strong pulsation immediately to its outer side, or if the finger be passed into the inguinal canal and patient made to stand up and cough, etc., the hernia, if femoral, will probably protrude apart from and unnoticed by the surgeon's digit.

We have therefore at least five signs by which femoral and inguinal hernia can be distinguished from each other, yet now and then a case baffles the most experienced surgeons unless verified by operation; especially if the woman be very stout or have very relaxed abdominal wall. The possible concurrence of a femoral and inguinal hernia on the same side should not be forgotten, for it is not excessively rare.

Sometimes a femoral hernia, instead of rising over Poupart's ligament, turns inwards towards the labium majus, or outwards towards the anterior superior spine. More frequently, especially if of large size, it may hang downwards. The oft-quoted case recorded by Deroubaix, in which a huge femoral hernia hung down as low as the patient's knee, is probably not unique. I have seen a similar instance in an old man where the hernia must have contained most of the



FIG. 33. An enormous femoral hernia which reached down to the knee. (Deroubaix.)

small intestine, but the patient had become thoroughly used to what would have seemed to be an intolerable burden.

In the museum of University College Hospital is a specimen of much interest obtained by operation on a very large femoral hernia—where the contents of the sac were so adherent that their resection was decided to be the only possible course. Mr. A. E. Barker excised the cæcum and a large appendix together with about a foot of greatly dilated and hypertrophied small intestine. The operation was naturally a very difficult and prolonged one, taking some three hours to complete, but the patient made an excellent recovery (Fig. 34).

4. The Relation of a Femoral Hernia to the Vessels.—It is an accepted statement that the efferent lymphatic vessels from the deep-seated glands in the groin pass up into the abdomen chiefly through the crural ring, but in operating on femoral hernia one never sees these vessels, and, however thoroughly the ring be closed by operation, there is never the least subsequent evidence of lymphatic obstruction. Much of the lymph from the lower limb must ascend in vessels running with the vein and artery to the outer side of the femoral canal, and for practical purposes we may ignore the question of the lymph trunks with regard to femoral herniotomy. Attention should, however, again be drawn to the frequent presence of a lymphatic gland in the ring itself or close to it, and the possible errors in diagnosis which may arise therefrom.

The “saphenous opening” normally gives passage chiefly to the long saphenous vein, and a femoral hernia emerging through the opening will have as its immediate lower relation this vein. Little difficulty in the operation, however, is likely to arise from this proximity. Sir Lenthal Cheatele¹ records that in order to block the femoral aperture he once resected over a foot of the saphenous vein and stuffed it into the ring, but it is questionable whether such a procedure is one to be imitated!

¹ *Proc. of Section of Surgery, Royal Soc. of Med.*, March 1922.

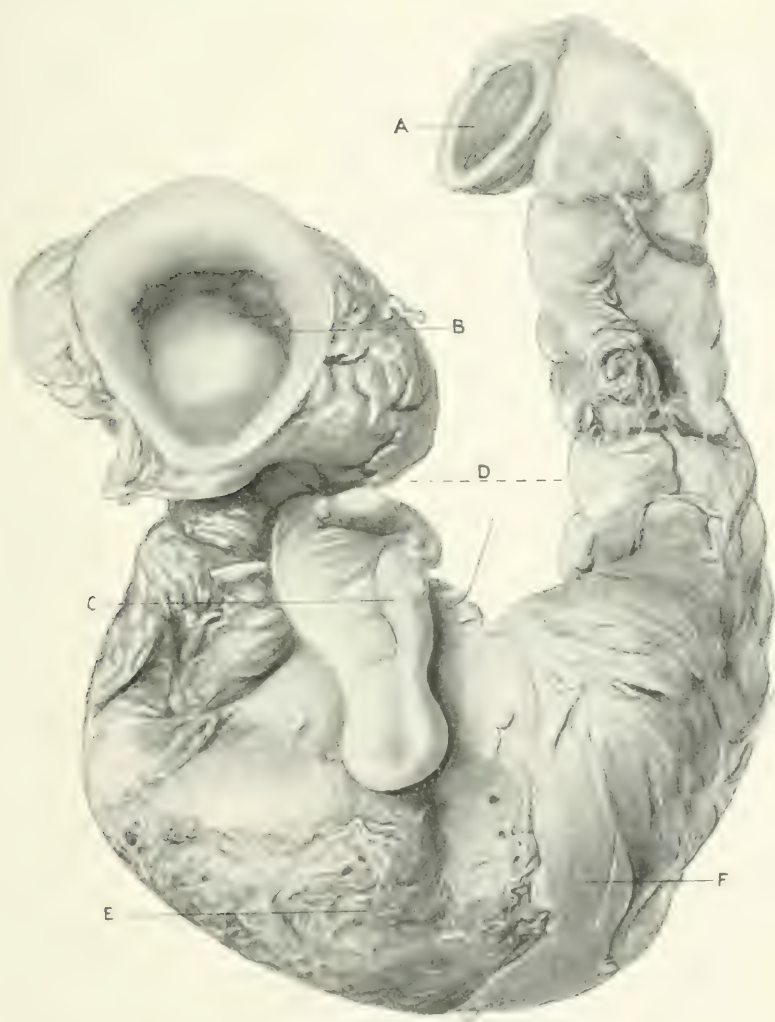


FIG. 34.—Resected portion of ileum (A to C) and of caecum (B) removed by Mr. A. E. Barker in an operation for radical cure of femoral hernia. (From Cheyne and Burghard's *Surgical Treatment*.)

Of great importance is the close relation which exists between the neck of a femoral hernia and the deep femoral vein, the former lying immediately to the inner side and tending to overlap the vein. Of the fibrous septum which is described as separating the middle and inner compartments of the femoral sheath one sees nothing during the operation, and it is worthy of note that M. Tillaux denied its existence. On the other hand, remembering the large size of the vein beneath Poupart's ligament, it is surprising how little it comes into evidence during the operation. One feels the pulsation of the femoral artery close to the outer side, but one has, so to speak, to imagine the vein between one's finger and the artery. Nevertheless if sutures are used to narrow the opening through which the hernia is passed, it is most important to guard the vein by the finger which depresses it away from the needle as the latter is introduced.

With due care the vein should not be endangered, and I have never personally seen a case of operation on femoral hernia in which it was wounded.

Another point arises—if the inner end of Poupart's ligament be forcibly fixed down to the pubis by means of Roux's staple or other means, there must be considerable risk of constricting the vein, nor is this the only objection to the staple method of narrowing the crural aperture.

It is difficult to see how the pad of a femoral truss controlled by a strong spring can fail to press injuriously on the vein at the same time as the canal; this partly accounts for the discomfort sometimes experienced from the use of a truss for this variety of hernia, much more than is the case in the inguinal one. McAdam Eccles, however, considers that "a perfectly fitting femoral truss is hardly ever irksome to the wearer, although an ill-shapen and improperly adjusted one will cause untold misery" (*On Hernia*, p. 174).

There is no proof that truss pressure ever cures a femoral hernia.

There is one arterial abnormality of special interest in regard to the femoral hernia, namely the aberrant obturator.

THE ABNORMAL OBTURATOR ARTERY

When the surgeon, at the critical stage of the operation for strangulated femoral hernia, is about to nick Gimbernat's ligament, the thought that an abnormal obturator artery may be in the way must occur to his mind. Undoubtedly there have been cases of its division by the knife, some of them fatal.

What is the risk, and how can it be avoided?

It is well known that the obturator artery has its abnormal origin from the deep epigastric in a large proportion of cases—1 in $3\frac{1}{2}$ or 30 per cent. This is due to the enlargement of the anastomotic arch between the pubic branches of the two vessels, and the abnormal obturator is present more often on one side than on both according to Richard Quain, who carefully examined no less than 361 bodies with regard to this point. J. Cloquet, however, who examined 125 found it bilateral in 56, unilateral only in 28.

In any case it is the course taken by the aberrant artery as it dips down towards the obturator foramen that is practically important, rather than its frequency.

If, as was found in 50 per cent of Quain's record, it runs down close to the iliac vein it will lie to the outer side of the femoral ring and cannot possibly be endangered, as no surgeon would dream of cutting *outwards*. In 37 cases out of 101 it ran across the femoral ring, and supposing a hernia to protrude through this it is obviously uncertain whether the vessel would be pushed to the inner or outer side of the sac. In 10 cases only did the artery curve over the femoral ring to dip down behind Gimbernat's ligament. Curiously, this dangerous course is noted most often in the female sex, in whom strangulated femoral hernia is far more frequent than the male.

From the above it is seen that the chance of the

abnormal artery being present and taking the dangerous course in the particular patient operated on, *and on that side*, is not great but is difficult to define exactly. Sir William Lawrence put it as low as 1 in 100; it can hardly be more than 1 in 50. Still there have been a fair number of cases of its accidental division, and one can well imagine the difficulty with which the bleeding artery would be secured.

As it is quite impossible to determine during herniotomy whether the abnormal artery is present or not, the safe rule is to assume that it is, and to nick the edge of Gimbernat's ligament only slightly (perhaps at two points) and to stretch the opening with the finger. One eminent surgeon of former days invariably blunted the edge of his herniotome before operating on femoral hernia—by no means a bad precaution.

RARE VARIETIES OF FEMORAL HERNIA

M. Paul Berger dissected two examples of hernia which, commencing outside the deep epigastric vessels, passed beneath Poupart's ligament and appeared in Scarpa's triangle external to the femoral artery. Similar cases have been recorded by Velpeau, Partridge, and others. I placed in the London Hospital Museum a large fatty hernia, the neck of which lay in front of the femoral artery; during the patient's life this had been diagnosed as an ordinary irreducible femoral hernia. It is naturally difficult in such cases (unless operated on or dissected) to be sure of the exact point of emergence of the hernia, and it is probable that these *external femoral* ones are less infrequent than is supposed. The essential feature of them is that the true femoral canal is not involved.

It is a strange fact (verified by several observers) that occasionally a femoral hernia works through an aperture in Gimbernat's ligament instead of to its outer side.

Equally curious is the course taken by a hernia which,

coming through the femoral ring, burrows underneath the pectineal fascia and the main vessels of the thigh, thus simulating in position an obturator hernia.

It will be noted that this remarkable subfascial hernia is the exact opposite of a hernia of muscle through its sheath (usually from an aperture caused by trauma), for instead of a bulging from within outwards the sac works from without through the sheath by some lacuna or gap which has gradually enlarged. Another example of this intramuscular hernia is afforded by a specimen in the London Hospital Museum (No. 1320A: the patient had been under Mr. C. Mansell-Moullin). Here the neck of the sac was in the right iliac fossa, just external to the iliac vessels: it penetrated the deep fascia of the iliacus muscle and lay between the latter and its sheath. The patient, a man of forty years, had recovered from four separate attacks of pain and swelling in the right iliac region accompanied by symptoms of intestinal obstruction. Evidently in these attacks intestine had entered the subfascial pouch and become nipped, but had been extricated by peristalsis. In the fifth attack—as proved by operation—the strangulation of a loop of small gut was so tight that perforation ensued with death from general peritonitis.

A fourth variety is afforded by a femoral hernia which has a diverticulum above the ring, this second sac lying in the subperitoneal space behind the pubis, etc. Its formation is probably due to repeated taxis having been employed, but some writers invoke for it a developmental origin. Strangulation may occur, not in the crural sac, but in its intra-abdominal or second pouch, and at least three cases are on record of successful operation on this form.

The question also arises whether the ordinary femoral hernia is ever of congenital origin, whether a tube of peritoneum is ever prolonged in early life through the femoral canal, as we know always occurs in the inguinal region in males and very often in females.

Though femoral hernia in children or young adults is of extremely rare occurrence, there is some evidence in favour of the belief that a congenital origin is possible. I operated on a young lady with a femoral hernia on both sides—the two sacs were exactly symmetrical, narrow peritoneal tubes which had every appearance of being of congenital origin: in this case an actual hernia existed on both sides. Small pouches or depressions of peritoneum at the femoral ring have been observed occasionally in children, though they are far more common in adults, in whom their origin is less likely to be congenital.

Bearing on the question just raised, it is of interest to note that Berger (out of some 8000 cases of hernia he examined) noted eighteen femoral herniæ in subjects under fifteen years of age: fourteen of these were in boys, four in girls. One dissection of a femoral hernia in a fœtus has been placed on record.¹

It may therefore be concluded that “congenital femoral hernia” is of undoubted though of rare occurrence, and even strangulation of such a hernia has been met with.²

The Diagnosis of Femoral Hernia.—A few words must suffice here on this matter. A saccular dilatation of the saphenous vein simulates a hernia in some respects, but if after emptying it fills up from below whilst the finger is kept over the ring the doubt as to its nature is dispelled; moreover, on coughing there is a thrill felt rather than an impulse, finally the saphenous vein in the thigh below is almost sure to be dilated and continuous with the supposed hernia.

I have known two cases of ruptured adductor longus (with hæmatoma) sent into the wards as strangulated herniæ, and a glandular or a psoas abscess in the deep femoral region give rise to the same error; indeed first-rate surgeons have operated on such cases in mistake.

¹ Société Anatomique, 1846.

² Stern, *Centralblatt für Chirurgie*, No. 19, 1894.

As to fatty hernia (see p. 23) it is practically impossible to diagnose this from an irreducible omental hernia before operation, and difficult to decide even during it.

The mistakes in diagnosis just alluded to are for the most part venial, the really important one *is to overlook completely a small strangulated femoral hernia*. It is here that the great majority of cases of Richter's hernia (nipping of a small part of the calibre of the gut) are met with, the right side being the one most often affected for some unknown reason.

Every museum contains typical specimens of this, the patients having died without the lesion ever being recognised.

The actual piece of gut strangulated in the ring may be smaller than a cherry, sac and gut together therefore being quite insignificant in size. Constipation may be absent, and vomiting slight until near the fatal ending.

The subject will be again discussed in the chapter on strangulated hernia (p. 208), but an extra warning against the tragedy of overlooking Richter's hernia cannot be out of place, especially as its occurrence is not very rare. I have in operating met with many examples, and my friend Mr. Warren Low had the remarkable experience of observing eight cases within twelve months.¹

Treatment of Femoral Hernia.—However small and easily reducible the hernia may be, operation for radical cure should be urged on every patient—unless special contra-indications exist, and this is rarely the case.

Again, in exceptionally large and long-standing herniæ operation should generally be performed, if only to enable a light truss to be worn and to lessen the risk of strangulation.

And I would urge that radical cure of femoral hernia, on the whole, well deserves its name, that if carefully performed recurrence should rarely happen, that after it the use of a truss should be dispensed with as a rule,

¹ Warren Low—six of these were reported, and the whole subject well discussed in a paper (*Med. Soc. Trans.*).

and that if the hernia *should* recur a second operation may well be advocated.

The Operation for Radical Cure of Femoral Hernia.

—It would be bewildering to discuss all the methods suggested for narrowing or obstructing the femoral ring in this operation, many of which have found no acceptance amongst operators, or after trial for a time have dropped into oblivion. Amongst the last named, I think, is the use of Roux's staple for fixing Poupart's ligament to the pubis; it will therefore not be further referred to.

There is general concurrence of opinion as to dealing with the sac, and, as already mentioned, some authorities hold that no more is required than this.

In discussing the anatomy of femoral hernia it has been pointed out that after obliteration of the sac the aperture through which it had protruded is found in many cases to be so small that it does not seem worth while to narrow it. But in other cases, I think the majority, the opening should be narrowed according to the method about to be described, *i.e.* from Scarpa's triangle (1). A wholly different method consists in approaching the hernia from above, through the inguinal canal, and by suturing down the conjoined muscles to the pectineal fascia (2). It is claimed for this that recurrence is less likely to happen, because the entrance to the canal is blocked, whereas by Method 1 the narrowing is made a good deal lower down.

As a matter of fact there is but little difference in the level of application of the sutures.

I have seen such excellent results from Method 1 that it may fairly be put first.

Method 1

The Incision.—The exact direction of this is not of much importance, owing to the ease with which the skin in this region can be retracted. The centre of the wound should be placed over the upper part of the saphenous

opening, half an inch below Poupart's ligament. Many surgeons make the incision vertical, extending a short distance above Poupart's ligament. Kocher places his incision along the inner third of this ligament. A curved incision with its convexity inwards and downwards seems to me the best, as the wound will then be placed as far from the genitals as possible, and will thus be well covered by the dressings.

The incision then begins over the external ring, nearly an inch above Poupart's ligament, and with a slight curve passes downwards and outwards over the saphenous opening for two or three inches. There is no layer of tissue with well-marked features, like the external oblique or the cremasteric layer in inguinal hernia, which the operator looks for. As soon as the superficial fascia is divided the sac is practically exposed. One or two adherent lymphatic glands may be found and may be later removed with the sac.

Treatment of the Sac.—The sac should be well isolated by a sweep of the finger before it is opened. Poupart's ligament and the superior cornu of the deep fascia are thus defined. The neck of the sac as a rule narrows remarkably as it passes beneath the cornu into the femoral ring. It is usually advisable to open the sac, unless the operator is certain by palpating the neck that it is empty.

In elderly subjects care must be taken if a projection or thickening be seen at the inner side of the sac—this might be a small pouch of bladder wall. If this should be suspected on no account should it be incised, but should be isolated, pushed within the abdomen, and the neck of the sac secured below it. In one case I met with an inflamed diverticulum of the bladder in a femoral hernia (elderly woman), which was entirely destitute of peritoneal covering. Hernia of the bladder is more often met with in the femoral region than the inguinal.

Any omentum in the sac is ligatured, cut off, and the stump returned within the abdomen. The empty sac is

now transfixed as high up as possible with a mounted needle, carrying a strand of kangaroo tendon, which is tied very firmly round the neck and the latter cut through with scissors half an inch below the level of ligature. One of the long ends of the tendon is again threaded on the needle which, guided by the finger inserted into the femoral canal, is made to emerge from behind forwards through the external oblique a short distance above Poupart's ligament. The finger flattens out the abdominal wall as the needle is passed, and as the subjects are almost always women there is not the spermatic cord to think of. But in a man special care should be taken to avoid the cord, which would be drawn up sufficiently with a blunt hook. The needle is withdrawn, leaving one long end of the tendon thread projecting through the aponeurosis: it is threaded with the other end and the manoeuvre repeated so as to make the latter emerge a few millimetres to one side of the first thread. Traction on both will bring the neck of the sac behind and above Poupart's ligament; it is fixed there by knotting together the tendon threads (of course fine silk or catgut will answer the purpose if the operator prefers their use). This fixation of the sac stump is easily performed and free from any risk. I believe it to be better than simply tying the sac, cutting off the ligature, and pushing back the stump. But perhaps there is not much in it, and certainly many surgeons adopt ligature without any fixation or anchoring.

Torsion of the sac is not really suitable in dealing with femoral hernia, and should not be employed.

Narrowing the Femoral Ring.—One writer observes that "the opinion is gaining ground that no attempt should be made to close the femoral canal."¹ This is indeed a change from the teaching that Poupart's ligament should be pegged down to the bone with a metal staple!

It must, however, be remembered that it is held to be

¹ Thomson and Miles, *Manual of Surgery*.

difficult to obtain a permanent radical cure of this form of hernia, indeed those who advise constant wearing of a truss after the operation¹ evidently regard it as impossible. I do not from my experience agree with this pessimistic view. Unless the opening that remains after return of the sac is very small (a mere chink) it is advisable to narrow, practically to close it. This in nine cases out of ten can be readily effected by two or three tendon sutures passed through (*a*) Poupart's and Hey's ligament in front or above, and (*b*) the strong reflected fascia over the top of the pectineus origin.

In passing these sutures on a fully curved needle the operator *must think specially of the femoral vein*, which he guards and displaces outwards with his left forefinger. As noted in the anatomy of femoral hernia, this vein, covered with its sheath and comparatively empty, does not show up as the important vessel it is. I will not deny the possibility of injuring the vein during the manceuvre of passing the needle, but so long as the finger guards the vein, and the operator looks carefully at the tissues through which he is inserting the needle, the accident ought never to happen.

The one, two, or even three tendon strands are now drawn on, and if thought advisable the tension is relieved by a small transverse incision through the pectineus fascia and muscle fibres below the ring, aided by an elevator or the handle of the scalpel. The sutures are now tied, *but the knots must not be unduly tight*. The wound is now sewn up.

Variations.—Instead of two or more separate sutures, which seems to me the best method, the front and back of the femoral aperture may be drawn together by a single mattress suture. An inferior method is that figured and advocated by J. P. Warbasse² of a purse-string suture of catgut encircling the ring. Such a suture of such material will probably cease to have

¹ McAdam Eccles is one of these authorities.

² Warbasse, *Surg. Treatment*, 1919, vol. iii. p. 39.

any narrowing effect in a few days and would therefore do nothing to hinder recurrence of the hernia.

There are other devices for blocking the femoral aperture. A flap of periosteum or deep fascia is too thin to be of use, but to close a femoral ring of considerable size a flap of the pectineus muscle may be turned upwards and united by sutures to Poupart's ligament. Sir Watson Cheyne in this country and Schwartz in Germany first advocated this method. Professor Sultan of Berlin states that he has had excellent results from dividing the whole of the pectineus muscle a couple of inches or more below its upper attachment and shifting the flap upwards, securing it to the ligament by multiple sutures.¹ The procedure is merely an extension or slight modification of Sir Watson Cheyne's; but it is obvious that if the whole thickness of the muscle is used for the flap and its nerve supply retained, the upturned flap is less likely to atrophy than if only a small portion is employed.

I have occasionally resorted to this flap method, but in the average case of femoral hernia where the ring—after complete return of the sac within the abdomen—is found to be small and easily closed, there seems to be no necessity for its use.

Method 2.—Suturing the conjoined Tendon to Cooper's Ligament through the Inguinal Route

This method seems to have first been described by Lotheisen,² it is also associated with the names of Parry, Gordon,³ and others. It has met with warm support from many surgeons, who regard it as the ideal operation for closing the femoral canal at the highest obtainable point.

The incision commences above the middle of Poupart's ligament, passes along the inguinal canal towards the external ring and then curves down over the femoral

¹ G. Sultan, *Spezielle Chirurgie*, p. 148.

² Lotheisen, *Centralblatt für Chirurgie*, 1898.

³ Gordon, *Brit. Med. Journal*, 1900, vol. i.

hernia so as to expose the sac. The latter is thoroughly isolated and opened, any contents being returned within the abdomen. The inguinal canal is laid open and the round ligament or spermatic cord drawn upwards by a retractor. The hernial sac is now pulled upwards through the femoral canal, its neck transfixed and firmly ligatured at its highest point, the sac below the ligature being then cut away. The lower edge of the conjoined tendon is then sutured by means of strongly curved needles to Cooper's ligament, two or three sutures being employed. This is the only difficult part of the operation, as special care must be taken not to injure the femoral vein, and in some subjects it is not easy to expose Cooper's ligament well (a head-lamp may be useful). "In this manner the entrance to the canal is effectively blocked by the resilient conjoined tendon. Additional security may be attained by sewing the pectineus to Poupart's ligament."¹ Finally, the cord or round ligament is replaced in front of the line of deep sutures, and the wall of the inguinal canal reconstituted.

NOTE.—A straight vertical incision is advocated by some, but the curving one seems better. Special "fish-hook" needles have been used for passing the deep sutures, which latter should either be of silk or kangaroo tendon, as catgut will be absorbed too soon.

There is no doubt that Lotheisen's method is an excellent one, and it may be that (as some contend) it will come to supersede those which aim at narrowing the femoral canal at the level of Poupart's ligament. Certain objections, however, can be raised to it.

1. There is more danger of wounding the femoral vein in working through the inguinal canal than from below.

2. The conjoined tendon varies in development and consequent ease with which it can be sewn down; it is of course useless to apply the sutures if they cause excessive tension (see pp. 28 and 70).

¹ R. Warren, *Text-book of Surgery*, vol. ii. p. 297.

3. The operation may be very difficult should the patient be stout of build.

It is of course open to the operator, if he finds this method impracticable, to narrow the femoral canal as described in Method 1. No harm will have been done by opening up and subsequent closure of the inguinal canal.

The great majority of the operations being done on women the question of displacing the spermatic cord rarely arises.

After-Treatment and Results.—As regards the after-treatment it differs in no material respect from that advised after radical cure of inguinal hernia (see p. 78). Sufficient rest in bed (two to three weeks) must be given to allow firm healing, and constipation must be guarded against for long afterwards. A truss should rarely be required. Recurrence is most apt to occur if strangulation has been present at the time of operation, which may of necessity be then hurried over, in cases of very large femoral ring (rare), and in thin patients liable to bronchitis. If suppuration has unfortunately followed the operation, of course the deep sutures are likely to work out and recurrence is very probable.

But taking all cases of femoral hernia together it is safe to expect about 80 per cent of permanent cure after well planned and executed operation. Should a second operation be required for recurrence, it will probably be found to present no special difficulty, in this respect differing from inguinal hernia.

OBTURATOR HERNIA

This very rare form of hernia has been given an importance in surgical literature which it does not deserve. Many elaborate papers have been written on it,¹ its

¹ For example, that by Picqué and Poirier, *Revue de Chirurgie*, 1891, t. xi. p. 693; one by Berger in Duplay and Réclus, *Traité de chirurgie* (Berger himself had only seen one case!), and a third by Dr. C. Firth (*Brit. Med. Journal*, April 19, 1890).

symptoms and treatment constitute a favourite topic at examinations, and every pathological museum possesses one or more specimens.

Its rarity accounts for the deceptive fact that records of 200 cases were collected and analysed by one writer. The fact is that many or most surgeons of wide experience never meet with a single case of obturator hernia, and that in the twenty years' experience of one of the largest hospitals in Great Britain only five cases of the kind were treated altogether (London Hospital, 1902 to 1921).

Of these five cases four were in elderly or old women : only one of the five recovered from the operation (this was performed from above through an abdominal incision and not through the groin). Other statistics give the proportion in females to be 7 to 1 in males.

Pathology.—The opening through which the hernia comes is small, at the upper corner of the obturator membrane, a good way to the outer side of and below the femoral ring : and the hernia will be covered by pectineus, femoral vessels, etc., and sometimes by part of the obturator externus. Three varieties have been described, and possibly some practical interest may attach to the division : (1) the hernia comes through above both the membrane and the obturator externus, there is then some chance of its forming a small lump in Scarpa's triangle which can be recognised : (2) it projects into the substance of the obturator when this will be impossible : and (3) it passes through a gap in the muscle itself.

More important is the relation of the neck to the obturator vessels and nerve : this is not constant, but, as a rule, they lay below and to the outer side—hence in herniotomy the liberating cut should be made *down and in*. Cases have been recorded in which the artery formed a ring round the sac-neck by its inner and outer branches (Sir A. Bowlby, Stanley, Picqué, and others). The nerve has been seen on the inner side.

The protrusion of the hernia is sometimes preceded by a lipoma, in this respect as in several others recalling

femoral hernia. For example, in both women at or past middle age are by far the chief subjects, in both the sac may become shut off (spontaneous cure), and although usually small and inviting the occurrence of a Richter's hernia of small intestine the sac by steady enlargement

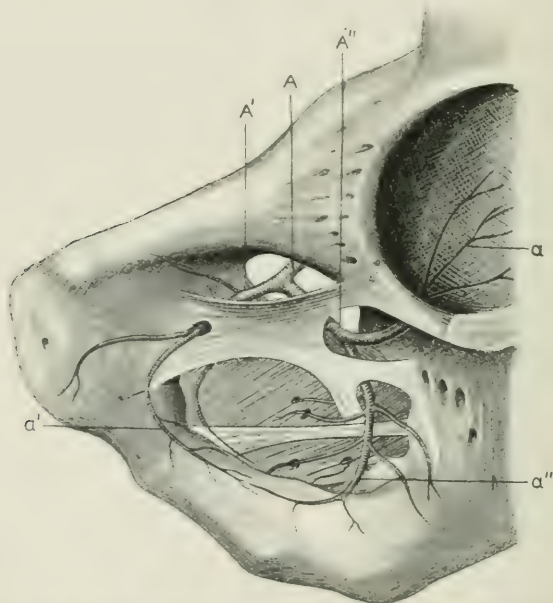


FIG. 35.—The left obturator foramen, showing the membrane single below but in two lamellæ above. A, The obturator artery dividing into internal and external branches (A' and A'', their final anastomosis is shown in a' and a''). An obturator hernia emerging below the pubic bone might obviously extend in any of three directions. The obturator externus muscle has been entirely dissected away. (Poirier.)

and stretching of the ring may come to contain viscera of considerable size (in a clearly recorded case of Brunner's, the uterus and the appendages were found in an obturator hernia!).¹ But if, owing to its small size, a femoral hernia is liable to be overlooked, ten times more so is an

¹ There is an unique case recorded of a large obturator hernia in a female child aged two years.

obturator. In both there is liability for confusion in diagnosis between the hernia and a deep glandular abscess or swollen varicose vein.

As contents of the sac we may note besides small intestine and omentum an occasional protrusion from the bladder, the vermiform appendix (on right side only), ovary and tube, etc.

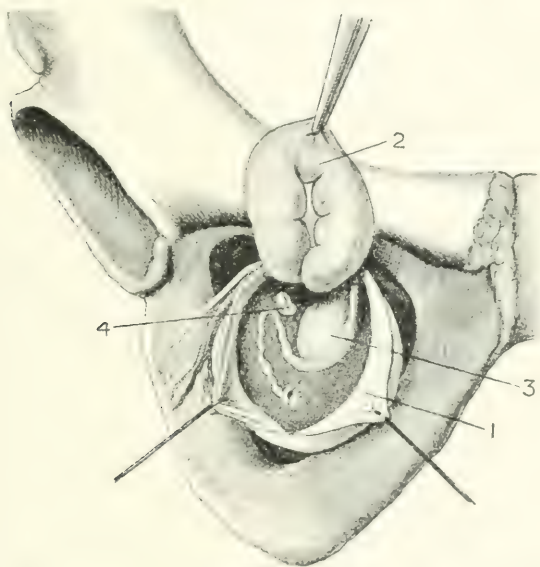


FIG. 36.—Right obturator hernia; the sac (1) contains a loop of small intestine (2), the uterus (3), both Fallopian tubes, and the right ovary (4). The obturator vessels and nerve lie to the outer side of the hernia as is generally the case. (Brünner.)

Note that a femoral hernia, perhaps on the same side, may coincide with a strangulated obturator one—and the operator may naturally be led to deal with the femoral one only, with of necessity a fatal issue (Auerbach).

The Diagnosis.—If the globular swelling can be detected under the pectineus, perhaps it can be ascertained that its neck goes under the pubis and not under Poupart's ligament close to the femoral vein (as in femoral hernia).

Examination per vaginam is said to be surprisingly effective. Of course an impulse on coughing in the deep lump would also help greatly.

It seems that (as happens in other herniæ) partial strangulation or inflammation of the contents may occur once or more times and the patient recover—thus firm adhesions may be produced which render any operation terribly difficult.

It is also probable that the sac itself is sometimes pushed or drawn back into the abdomen. Both these factors might complicate the diagnosis—difficult enough in any case.

As the aperture between obturator membrane and bone is small and will not stretch readily, the nerve may reveal symptoms from pressure which are absolutely peculiar to obturator hernia—there is no other form in which they can occur. They consist in (1) shooting or fixed pain referred to the inner side of the knee, perhaps even towards the foot; (2) weakness or spasm of the adductors; (3) flexion of the hip; and (4) impaired sensation in terminal cutaneous distribution of the nerve (this must want exceptional skill to detect!).

Howship first called attention to this feature (by no means invariably found) of nerve-pressure in obturator hernia, and it might be called “Howship’s sign,” but unfortunately the term “Romberg’s sign” has got attached to it—both had better be forgotten.

In spite of this sign, in spite of the aid of vaginal examination, in spite perhaps of the actual detection of an expansile lump under the pectineus, the fact remains that obturator hernia is rarely diagnosed before death, or operation for “intestinal obstruction.” Its extraordinary rarity of course partly accounts for this.

Treatment.—This is purely operative, and in spite of M. Berger’s contemptuous reference to it surgical opinion has come round to the abdominal route, *i.e.* attacking the hernia from the general peritoneal cavity instead of through the muscles of the thigh. By neither

route, it must be admitted, have the results been at all satisfactory. However, it seems to me that if an obturator hernia were diagnosed or suspected the best course to adopt would be as follows :

1. The patient being anaesthetised and placed in the Trendelenburg position (the bladder having been first emptied), a median laparotomy is performed.

2. Both obturator and femoral rings are examined with the finger or by an electric head-lamp. If a hernia is found the ring can probably be stretched, by means of a blunt flat hernia director, sufficiently to allow the contents to be drawn back. If not, the lower edge of the ring is incised with a herniotome. The strangulated loop is dealt with according to its condition. The sac could probably be drawn inwards and removed : if not its neck could be sutured and the sac drained if necessary in the thigh.

I have not had personal experience of this intra-abdominal method, but found it most satisfactory in a case of strangulated para-vesical hernia in which the sac was quite as deeply placed as the obturator foramen, and was indeed close to it. After liberation of the knuckle of gut it was easy to complete a radical cure by suturing the sides of the small sac together.¹ It is, however, obvious that if the obturator hernia contained *firmly adherent* intestine or omentum the abdominal route would not enable the surgeon to deal with this, and therefore a description of the older method is given in addition.

The pelvis of the patient should be well raised on a sand-bag.

The parts having been duly cleansed, a vertical incision, from three to four inches in length, is made over the tumour, midway between the line of the femoral artery and the spine of the pubes. The subcutaneous tissues and fascia lata having been divided, the upper edge of the adductor longus muscle is reached. The deep external pudic artery would probably be severed.

¹ J. Hutchinson, *Med. Chir. Soc. Trans.*, 1899, p. 305.

The upper border of the long adductor is pulled downwards and inwards with a wound retractor.

The fibres of the pectineus muscle are either separated by using the handle of the scalpel, or are divided transversely.

The obturator muscle is next defined, and the sac exposed by a little careful dissection. The hernia may protrude above that muscle or through its uppermost fibres.

The thyroid membrane is then nicked in a downward direction, and the gut reduced. The sac may or may not be opened. Care must be taken not to wound the femoral or saphenous veins. In dividing the constriction, a lateral incision should be avoided. The sac may be dissected out, and its neck ligatured, as was done in Dr. Firth's case. Before the wound is closed, a drainage tube should be inserted.

Dr. Firth states¹ that out of twenty-five cases recognised during life, seventeen were subjected to operation, eight were relieved by taxis, but only five altogether were saved by the two methods of treatment.

A collection of twenty-five published cases of operation (made by Auerbach) gives a better percentage of recoveries than Firth's, as eleven out of the twenty-five patients survived. But it is to be noted that successful cases are far more likely to be published than the others.

Other Rare Forms of Hernia.—A few words of reference must suffice for these, as the chance of operating upon any of them is quite exceptional.

Lumbar Hernia.—Mr. Macready² collected twenty-five recorded examples of this hernia. In six, strangulation occurred; of these, two were operated upon: one recovered and one died. One case appeared to have been untreated, and the remaining three were successfully dealt with by taxis.

I observed one case of a large lumbar hernia in an

¹ *Loc. cit.*

² *Lancet*, Nov. 8, 1890.

elderly man: the colon protruded into it and could be readily reduced by taxis. The patient died from other causes, and I dissected the specimen (now in London Hospital Museum). There was a mass of subperitoneal fat round the hernial sac *which latter was reducible with the contents*. The hernial orifice had nothing to do with "Petit's triangle," and probably this is the case in most examples of lumbar hernia.

The radical cure of a lumbar hernia offers no particular difficulty. After ligature and return of the neck of the sac the opening in the muscles should be thoroughly closed by buried tendon sutures.

The first operation of this kind was performed by Mr. Edmund Owen.¹

Two cases of non-strangulated lumbar hernia have been operated on successfully at the London Hospital in the course of the last twenty years, a sufficient indication of the rarity of this form.

Sciatic Hernia. M. Wassilieff² describes a case in which strangulation occurred. The rupture was successfully reduced. He enters fully into the anatomical relations of this uncommon hernia, and the operation which should be carried out, should such treatment be demanded.

One similar case was met with at the London Hospital during the last twenty years: the contained gut was gangrenous and was resected with end-to-end union. The patient recovered—a brilliant result.

Pre-vesical Hernia. On this very exceptional form I may refer to two papers by Sir G. H. Makins and myself.³

Of the other rare internal herniæ—diaphragmatic, hernia into the foramen of Winslow and the duodenal or peri-cæcal fossæ, etc.—I have had almost no experience. As the question of their radical cure rarely arises it is unnecessary to deal with them here. The use of the

¹ *Brit. Med. Journ.*, May 5, 1888.

² *Revue de Chirurgie*, March 1891.

³ *Med. Chir. Soc. Trans.*, 1899.

X-rays has enabled diaphragmatic hernia to be recognised and treated with greater ease than in former times. Mr. C. B. Keenan of Montreal operated on two cases with success: both were the result of trauma (in one a bullet wound inflicted four years before, in the other injury by a bull's horn—operation the next day after the accident). In both the hernia was on the left side and involved the stomach, in one the spleen also protruded into the thorax. In the first case epigastric pain coming on after meals led to resort to the X-rays and to discovery of the hernia. The left eighth rib was resected—but the writer did not believe this was essential if “an antero-lateral incision involving abdomen and thorax” were employed. The diaphragmatic aperture was closed “with overlapping” (Keenan, *Annals of Surgery*, 1922). Reference may be made to two other papers on the subject (both containing accounts of successful operations) by C. L. Scudder, *Trans. Amer. Surg. Assoc.*, 1912, p. 428, and Balfour, *Annals of Surgery*, 1916, p. 78.

CHAPTER VII

HERNIA OF SPECIAL ORGANS — STOMACH, UTERINE APPENDAGES, VERMIFORM APPENDIX, BLADDER, ETC.

MOST of the abdominal viscera have been met with as contents of one or other variety of external hernia. In fact the pancreas, duodenum, and suprarenal capsules are probably the only exceptions. The strangest things have happened in this matter : a wandering spleen has been found in an inguinal hernia, the uterus in an obturator one, a misplaced testis in the femoral canal, the liver in a congenital umbilical hernia. I have myself met with the cæcum and appendix in a *left* inguinal one. Even a floating kidney has thus escaped from the abdominal cavity.

But these rare occurrences require no description here, and it is unnecessary to go through the abdominal viscera in detail. The small intestine and omentum are so constantly found in herniæ that they have been referred to on almost every page : the large intestine is so often met in umbilical, and to a less extent in voluminous inguinal herniæ, that it also needs no further comment.

Hernia of the stomach, or rather of a portion of this viscus, is admittedly rare, but its brief discussion will introduce the question of operation on voluminous or giant herniæ. Those of the other viscera to be described—ovaries, etc., vermiform appendix, and bladder—present many features of interest and difficulty, and deserve fuller treatment than they usually receive in surgical works.

HERNIA OF THE STOMACH

In advanced life it is remarkable how low in the abdomen the stomach and transverse colon may sometimes descend, usually as a part of general visceral prolapse (Glénard's disease) but sometimes from pyloric obstruction due to cancer, etc.

Even the pylorus itself, usually regarded as constant in position, may be greatly displaced; thus in one elderly female subject on operating I found the small cancerous pylorus *behind her right Poupart's ligament*, and in order to effect a gastro-jejunostomy the stomach had to be raised up greatly from the lower abdomen. The widespread use of X-ray examination has shown us that the stomach often descends in the abdomen much lower than the normal without of necessity causing symptoms.

From these considerations we should expect hernia of the stomach to be of possible occurrence in either the femoral or inguinal variety. In diaphragmatic, umbilical, or ventral hernia in the upper abdomen it may easily form part of the contents.

The following abstract of an interesting case bears out what has just been stated:

HERNIA OF THE GREATER PART OF THE STOMACH, SMALL INTESTINE, AND SIGMOID FLEXURE IN A LEFT INGUINAL SAC.¹

An old man (77 years) in the Bicêtre Hospital in Paris for long had had a large inguinal hernia on the left side only. One day it became larger, more tense, and painful about the region of Poupart's ligament, and there was vomiting. Nothing is said about impulse on coughing, but after treatment by a hot bath (which made him faint) it was easy to reduce part of the hernia with gurgling. Flatus was passed per anum. The case was not thought suitable for operation, and it would have answered better to the old term of "incarceration" than strangulation. The patient's pulse became thready, and he had intense dyspnœa, dying on the third day after the hernia had begun to give trouble. The post-mortem showed some constriction of large intestine in three places

¹ Chevereau, *Bulletins de la Soc. Anatom.*, March 1894.

but no strangulation. The heart was normal and the lungs merely congested at their bases—hence we must conclude that death was caused by “abdominal shock” or peritoneal irritation from the partial obstruction acting reflexly on the heart.

The hernial orifice extended the whole length of Poupart’s ligament! Through it bulged into the scrotum—

1. All the small intestine except the duodenum and a small part of the jejunum.

2. The iliac and part of the descending colon, the mesentery of these portions having slid down along the posterior wall of the sac. There were three separate constrictions of the large intestine caused by the hernial ring.

3. A large part of the stomach, from near to the pylorus, for a length of 15 cm. (6 in.) of the lesser curvature and 35 cm. (14 in.) of the greater curvature. This would be equal in size to a normal stomach, but that part which had remained within the abdomen was still larger owing to dilatation—measuring 18 cm. (7 in.) and 48 cm. (19 in.). Grooves in the stomach wall indicated that the herniated portion had been pressed upon by Poupart’s ligament, etc., as well as the colon.

The total length of the stomach attained these extraordinary figures: nearly 1 foot measured along the lesser curvature and over 33 inches along the great curvature!

Unfortunately the exact position of the pylorus is not stated, but a rather poor illustration indicates that it was displaced near the right anterior superior spine. The cæcum was normal in size and near the mid-line of the abdomen; it had not been in the hernia.

Both kidneys were normal in position.

Here is a typical example of a “giant hernia” containing within its sac the greater part of the alimentary tract. Such cases may be inguinal, femoral, umbilical, or ventral, especially through old laparotomy wounds made below the umbilicus. The inconvenience they cause to their bearer may be smaller than one would naturally expect. I have seen one elderly man with an enormous hernia reaching almost to his knees when he stood up: he complained but little!

What can surgery do in such cases ? Rash or "heroic" operating courts disaster : on the other hand a very large hernia (after careful selection and preparation) is now and then operated on with complete success.

Three of the chief difficulties are illustrated by the preceding case : first, the long-continued presence in the hernia of most of the gastro-intestinal tract, the abdominal cavity being no longer adapted to contain it ;¹ secondly, the not improbable "landslide" of cæcum or sigmoid in such a hernia which will greatly hamper a radical cure being effected ; thirdly, the great size of the hernial aperture which would have to be closed.

To these, in the case of very large femoral or inguinal hernia, we may add the possible prolapse of part of the bladder on the inner side of the sac (see *Hernia of Bladder*, p. 197).

HERNIA OF THE OVARY AND FALLOPIAN TUBE

Many cases in which this condition has been diagnosed clinically have proved on operation to be nothing more than ordinary omental herniæ, nevertheless true hernia of the ovary—with or without the Fallopian tube—are not very uncommon. Puech was able to collect records of over 100 cases of its occurrence. The inguinal variety, *i.e.* into or towards the labium majus, is by far the most frequent (88 per cent), the remainder being femoral, with a few exceptional instances in the obturator region.

1. A considerable proportion are congenital in origin, and may therefore be met with at any time after birth. In one case I operated on, the infant was only a few months old.

It is noteworthy that in these congenital herniæ (for they may be symmetrical) some abnormality of the

¹ I knew of one such case in which the intestines were forced back with great difficulty into the abdomen from which they had for long been absent in the hernial sac, and the radical cure completed. The patient died within twenty-four hours of respiratory trouble due to the distended abdomen.

uterus has been found to co-exist. It may be bicornuate with one horn protruding with its appendages into the corresponding labium, or otherwise defective in development: now and then there is the strange condition of transverse hermaphroditism—when the external organs are male, but there is a uterus and vagina opening into the prostate and two globular bodies in hernial sacs difficult to determine whether they are ovaries or testes (cases reported by C. Stonham and the author).

It is affirmed that the herniated ovary is particularly liable to cystic degeneration, and to become the site of new growth (adenoma or carcinoma), and this tendency is held to justify the operator in adopting excision rather than replacement of the organ, unless it appears to be normal. It should not be forgotten, however, that ovaries in young children differ considerably in shape and appearance from the adult organs, being elongated and flattened, hence a too hasty decision in this matter must be avoided. If the surgeon, when operating on an inguinal hernia in a girl, discovers the ovary in the sac he should return it within the abdomen, unless the signs of degeneration or disease are well marked. Hernia of the ovary in early life is almost without exception *inguinal*, and if not symmetrical there will probably be found a potential hernia on the other side.

Of course a child with congenital abnormality of this nature may grow up to adult life without undergoing operation.

2. Acquired hernia, either inguinal or femoral, is certainly predisposed to by repeated pregnancies. It is practically always unilateral. As in the congenital form the Fallopian tube may or may not accompany the ovary. In some cases a portion of the broad ligament forming the mesentery slides down in the wall of the sac, analogous to the sliding hernia of the cæcum, or the sigmoid flexure, or the bladder. Such a hernia will present special difficulty as to reduction during the operation, a very careful dissection being required.

3. As noted above, the Fallopian tube sometimes accompanies the ovary into a hernia, but many instances have been met with in which the tube alone was found either in a femoral or inguinal hernia, recognised by its fimbriated extremity. It may be difficult at first sight to distinguish between it and the vermiform appendix.

The chief interest of a herniated tube lies in the fact that it is liable to become cystic or inflamed. The condition of pyo-salpinx inside a hernia is a serious one, as firm adhesions to the sac wall may render its excision a very difficult operation. In such a case the tube should be attacked and ligatured as high up as possible in the neck of the sac (*i.e.* towards its uterine attachment), and dissected out from above.¹

Symptoms and Diagnosis.—There may be little evidence to point to the existence of an ovary in a hernia apart from the detection of a globular body, more or less mobile in the sac, probably tender to palpation. But if the patient is an adult, or has reached puberty, there will be noted at each menstrual period special discomfort or pain in the region of the hernia.

The possible occurrence of torsion (exactly similar to that of the testis), of cystic enlargement, and of new growths must be borne in mind.

Some help in the diagnosis may be obtained by examining the connection of the supposed herniated ovary with the uterus on bimanual examination.

It is curious how closely a lump of omentum in an inguinal hernia can simulate the female appendages. A cyst of the canal of Nuck may be indistinguishable from one of a herniated Fallopian tube, and both lipomata and inflamed lymphatic glands have been occasionally mistaken for hernia of the ovary.

Treatment.—Without exception the patient in whom

¹ M. Guinard operated on such a case, in which the swollen Fallopian tube in an inguinal hernia felt exactly like a retained testis. M. Turgis incised an inflamed tube in a similar case, and for a year subsequently the patient menstruated through the fistula (*Bull. de la Soc. Anat.*).

hernia of an ovary or tube (or both) is diagnosed should be submitted to operation for radical cure. If fairly healthy the contained organs should be returned, the sac ligatured high up and excised, and the canal sewn up.

The chief difficulty arises where the tube has been inflamed and is adherent, or where ovary, tube and broad ligament have together slid or prolapsed into a hernia. In the latter case it may be necessary to return an isolated part of the sac wall together with the contents.

It is, of course, not advisable to perform a radical cure during pregnancy, but cases have occurred in which torsion of the appendages or strangulation of intestine within the sac has compelled operation during this critical period. It is rare for the appendages, either ovary or tube, to be really strangulated by themselves, though inflammation is doubtless favoured by impeded circulation at the hernial rings. The use of a truss in most cases of hernia of the uterine appendages is irksome, unsatisfactory, and may well become intolerable. All these considerations point strongly to the rule—urge operation before complications have time to ensue.

HERNIA OF THE VERMIFORM APPENDIX

One of the most interesting features of hernia of the appendix, distinguishing it from hernia of other abdominal organs, is the frequency of inflammation and suppuration within the sac, complications which give rise to a relatively high mortality. There is no doubt that many of the cases recorded as strangulation of the appendix are really examples of acute appendicitis which happens to occur within a hernial sac. In some the pressure of a truss or the irritation of repeated taxis is attributed as the cause of this inflammation, but other factors more probably come into play. Once the appendix has become the permanent inmate of a hernia, its contents will be apt to stagnate and decompose at the lower end, and micro-organisms, in particular the *bacillus coli*, will have a

greater chance of invading the wall of the appendix when the blood supply of the latter is interfered with by kinking or direct pressure at the neck of the sac. Occasionally also a foreign body, such as a fishbone, a pin, or a hard concretion leads to perforation of the appendix within a hernia. Of this the following case is an example :

In 1892 I operated for "strangulated" inguinal hernia (on the right side) on a middle-aged man. A loop of small intestine was present in the sac, but considerable difficulty was found in returning this, although the aperture leading into the abdomen seemed large enough. An obstacle was found in the inguinal canal in the form of the vermiform appendix, which on being drawn down was seen to be inflamed and swollen at its base, with a small gangrenous patch over a sharp substance within the appendix itself. The latter was then carefully excised and its base sutured. On opening it a foreign body, the nature of which could not be exactly ascertained, was found to be impacted. The foreign body was a circular disc, like the very hard scales seen on certain fish, with a sharp spine projecting from its centre. The spine had become fixed in the wall of the appendix, and thus led to perforation.¹

Some writers have questioned whether true strangulation of the appendix ever occurs ; but it must be remembered that, together with the fat investing it in some persons, the appendix may be even larger than a loop of small intestine, and the nature of its blood supply—that of a terminal organ—especially favours its complete obstruction by a hernial ring. Fig. 37 illustrates the occurrence of suppurative appendicitis within a hernial sac, showing the cæcum, which was fixed at the neck of an inguinal hernia owing to the vermiform appendix being inseparably united to the wall of the canal, only the lowest inch of the appendix being free in the sac. The patient was an old man, admitted into the London Hospital with a large abscess in the right scrotum, who died from pyæmia due to the suppuration. Several

¹ J. Hutchinson, *Tr. Path. Society*, February 7, 1893.

sinuses are seen, due to a perforating ulcer in the wall of the appendix, 2 inches from its extremity. There had been throughout no symptoms of strangulated bowel, nor had either fæces or gas ever escaped from the abscess cavity.

It will be seen that the appendix in this case illustrated the conditions mentioned before in being dependent and unable to empty itself owing to the extensive adhesions towards its upper part; further, its orifice leading into the cæcum was at the very lowest point of the latter.

In many cases of hernia of the appendix death has resulted from extension upwards of the suppuration, and sometimes from the return by the surgeon of the inflamed organ into the peritoneal cavity. We have then to think of septic inflammation as a not infrequent and dangerous sequence of hernia of the appendix, whilst sometimes the latter becomes the seat of many relapsing attacks exactly like those met with in the iliac fossa.

The fact that occasionally such an attack has preceded the development of the external hernia has been noted

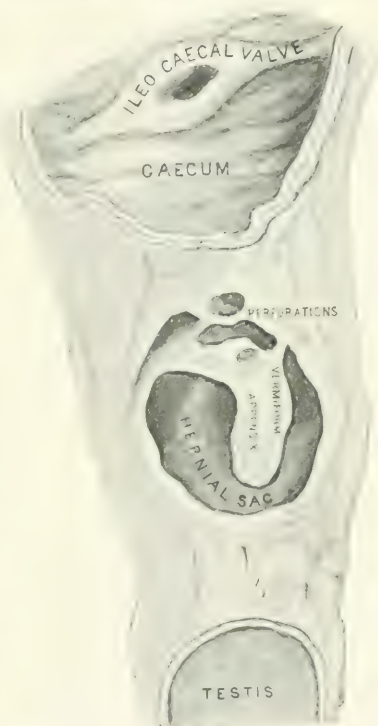


FIG. 37.—Dissection of a right inguinal hernia containing only the inflamed and perforated vermiform appendix, suppuration around which led to death. The upper part of the appendix is inseparably matted to the wall of the sac. (Specimen in the London Hospital Museum.)

by one or two observers. Thus Mr. W. H. Battle,¹ in recording a case of radical cure of an inguinal hernia which contained the appendix and omentum, writes : " There had been catarrhal inflammation of the appendix, and it was probable that the protrusion occurred after the inflammatory attack." But I do not think any one has yet put forward the view that inflammation of the appendix is a direct cause of its becoming engaged in the femoral or inguinal ring. We know, however, that the inflamed appendix may become swollen, stiffened, and elongated ; it is, in fact, under certain circumstances, an erectile organ. Fig. 38 is taken from the section of such an appendix, which at the operation for its removal projected forwards, deep red in colour, and as firm as one's little finger. The section shows the dilated arteries and veins, alike in the submucous coat and in the subperitoneal layer. The appendix, when free, is often directed forwards with its apex just behind Poupart's ligament. What is more likely than that such an appendix, if inflamed, should protrude into and become adherent to one of the small pouches which, especially in adults, occupy the femoral and inguinal rings ? Many points in the history of cases of hernia of the appendix could be adduced to strengthen this view.

The theory now advanced that an attack of appendicitis may, and in a good many cases does, lead to the first protrusion of the hernia seems to clear up several hitherto obscure points, such as the recurrence of inflammatory attacks in cases where the operator finds not the slightest cause for strangulation in the hernia. The cases in which the tip of the appendix alone is found adherent to the wall of the sac are thus explained, as well as those in which the history has been that of pain in the iliac fossa with sickness preceding the formation of any obvious hernia. The fact that a clear history of prior appendicitis may not be obtained does not in the least disprove the theory. The last few years we have begun to realise how extremely

¹ Battle, *Lancet*, 1899, vol. i. p. 1631.

common appendicitis is, and how slight its symptoms

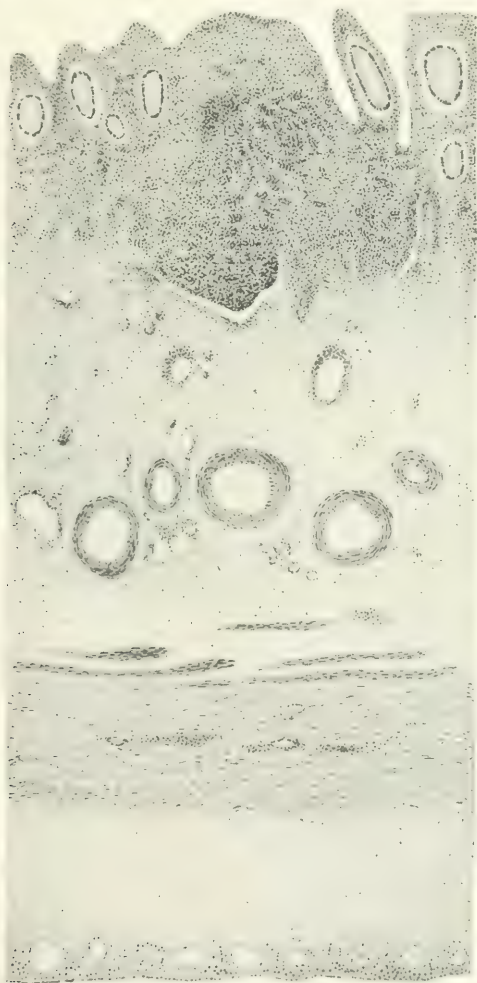


FIG. 38. Transverse section through the wall of an acutely congested vermiform appendix, excised when in a state of erection. There is moderate cell infiltration of all the coats; the dilated vessels in the subperitoneal and submucous layers are well shown.

may be so long as actual suppuration does not occur. It is certain that many people go through an attack without

“lying up” or seeking medical advice, and it is equally certain that repeated attacks may leave the appendix apparently in a healthy condition. A striking instance of the latter fact was afforded by a man who had gone through over forty typical and sometimes severe attacks of appendicitis. I excised his appendix, which to the naked eye presented absolutely nothing abnormal; in particular there were no adhesions, and the microscopical changes were of the slightest. Bearing this in mind, the frequency of appendicitis may be roughly guessed at from the fact that nearly 20 per cent of adult subjects (who had died from other causes) examined on the post-mortem table at the London Hospital showed signs of old disease of the vermiform appendix. According to one writer the percentage is higher, 40 to 50 per cent. Believing that an inflamed appendix may readily insinuate itself into the femoral or inguinal ring, I think hernia of this process would be a more common occurrence but for two facts: (1) In 40 per cent the appendix has no mesentery, and is anchored down, and even when comparatively free, in a good many cases it is directed upwards, behind, or at the side of the colon; and (2) it may be so short, perhaps only an inch in length, that it is impossible for it to enter the hernial rings.

The Diagnosis of Hernia of the Appendix.—Inflammation of the appendix, when the latter has entered a hernia, leads to such changes in its shape, etc., as may render it almost unrecognisable at the time of operation. One of the most remarkable of these changes is that of cystic dilatation. There is a specimen of this in St. Bartholomew's Hospital Museum, and Wölfler,¹ Weir,² Guttmann,³ and others have recorded examples. It would be difficult to believe that these large cysts, four inches or more in diameter, have merely originated from the appendix; but examples of its occurrence un-

¹ Wölfler, *Archiv für klin. Chirurgie*, Band xxi. p. 432.

² Weir, *New York Med. Record*, 1880, p. 144.

³ P. Guttmann, *Deutsche med. Woch.*, 1881.

doubtedly have been proved within the abdomen, where the appendix has been found dilated to the size of the small intestine, and containing many ounces of mucoid fluid. In fact, one expects that some day a dilated vermiform appendix will be operated on as an ovarian cyst.

In dealing with a case of hernia of the appendix,

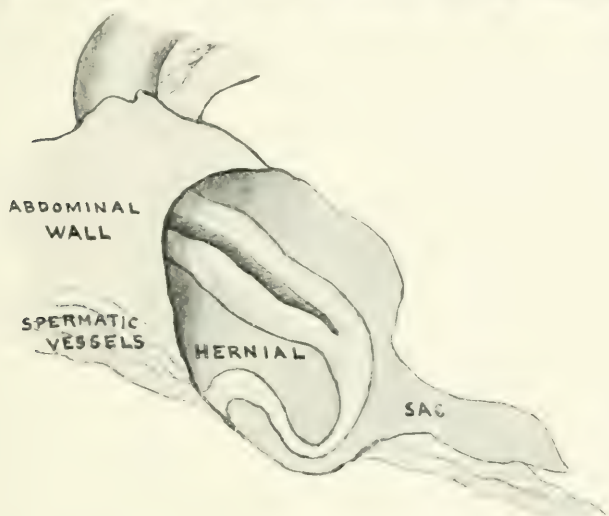


FIG. 39. Dissection of a right inguinal hernia, containing only the vermiform appendix, which probably protruded when inflamed, and became adherent at its tip to the sac. The mesentery of the appendix is seen above the internal ring, and the lumen exposed within the sac; the last inch or so of the appendix being blind. (Specimen in the museum of the Royal College of Surgeons.)

supposing that the latter has not been inflamed and the sac wall is thin, the characteristic worm-like form may be recognised (in several cases of congenital right inguinal hernia in young adults that I have examined the appendix could be plainly recognised through the skin, and made to return into the abdomen).

In the more important cases of adherent and inflamed appendix the difficulty of diagnosis may be very great.

The symptoms of strangulated intestine may not be present, or only ill-marked, and the hernia, especially if femoral, may be only the size of a walnut. On incision the sac is usually found to be greatly thickened; in one of my cases it appeared to have so firm a layer of muscle that I suspected it was the wall of the cæcum.

In other cases no sac has been recognised, merely an abscess cavity opened, at the bottom of which lay a dusky, swollen body, the inflamed appendix. The latter may be buried in adherent omentum, though it is remarkable in what a large proportion of cases the appendix is the sole inhabitant of the sac. In the female sex the swollen appendix may resemble exactly the Fallopian tube, the following case being a good example:

An old woman, aged 85, was admitted into the London Hospital with the diagnosis of strangulated right femoral hernia. The tumour was the size of a hen's egg, and tense; there was no impulse, but the symptoms of strangulation were only mild. Her tongue was fairly clean; there had been slight sickness only, but considerable pain about the hernia and in the abdomen. She had known of the hernia for a long time, and had worn a truss. The operation showed the contents of the sac could not have been really reduced. The operation was performed within a few hours of her admission, and the sac was found to be remarkably thick and rigid, part of the wall having the appearance of muscular tissue. The suspicion arose as to its being intestine, for example, cæcum; however, this was not so: the contents of the sac consisted of nearly pure blood. Far back in the sac a solid, lobulated body was felt, forming a ridge which somewhat resembled a cock's comb. This measured about 3 inches from the very narrow femoral ring to a firm old adhesion at the end of the ridge. Between these two points the body was free, and was made out to consist of a tube 1 cm. or less in diameter, alongside of which were purple or black lobulations, evidently fat covered with peritoneum.

As already mentioned, the tube was firmly adherent at its end, and seemed to be continuous with the sac wall. The nature of the hernia now became clear, in so far that the tube

could only be an elongated and thin vermiform appendix, or the right Fallopian tube with its broad ligament. In favour of the tube being the appendix was the fact that no trace of fimbriae could be found, against was the fact that the tube was of such very small dimensions (1 cm. or less in diameter). Improbable though it seems, hernia of the Fallopian tube alone in the femoral canal undoubtedly may occur; Dr. Tischendorf operated on one such case, and was able to collect records of four others.¹ A double silk ligature was made to encircle the pedicle close to the femoral ring, and

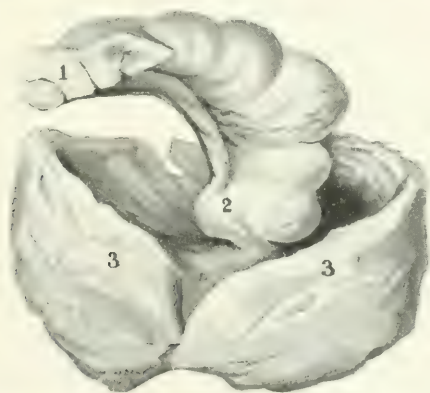


FIG. 40.—The vermiform appendix (1) with a lobulated ridge of fat making it resemble a Fallopian tube, adherent at its tip (2) to the sac of a femoral hernia (3). Natural size.

the whole sac and its contained tube excised after transfixion and ligature of the former at its neck. Altogether $2\frac{1}{2}$ inches of the tube were removed. It will be noted that the chief points in the case were: (1) An extremely thick sac wall; (2) the fluid contained being nearly pure blood; (3) the only solid contents being an inflamed long tube with peritoneal appendages.

A careful microscopic examination of the tube was made. Its wall was formed of two regular layers of muscular tissue, the outer longitudinal and the inner circular; inside these were areolar tissue, fat, and vessels, but no distinct lumen

¹ *Proceedings of the Leipzig Obstetric Society.*

could be found (see Fig. 41). On the whole, looking at the

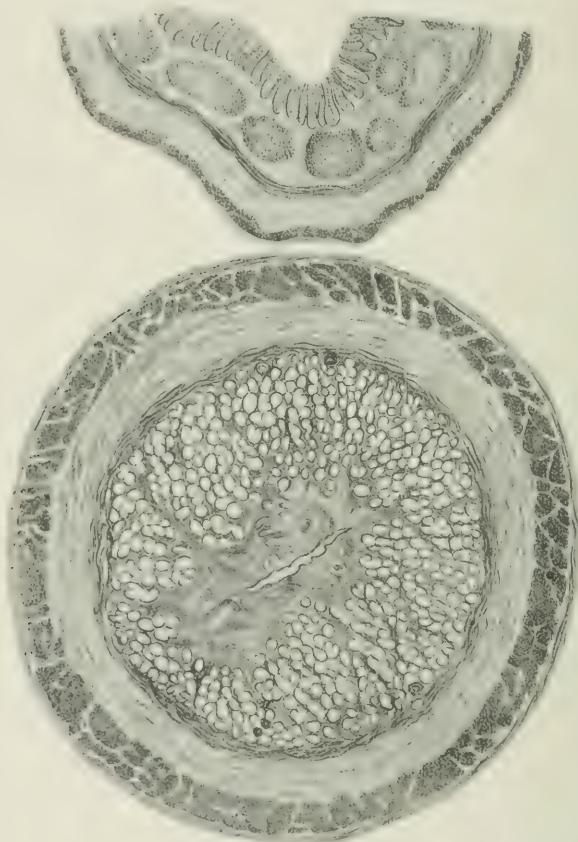


FIG. 41 (copied from Wölfler).—The upper section represents the normal vermiform appendix in early life, with its tubular and lymphoid glands and well-marked lumen. The lower section, from an elderly subject, shows a degenerated appendix in which the lumen has practically disappeared, whilst only traces of the tubular glands can be detected. The submucous layer is laden with fat. The drawing might have been made from the appendix described above (see Fig. 40.)

regular layer of longitudinal muscle fibres, and the failure to prove the presence of fimbriæ, there can be but little doubt

that the tube was the degenerated vermiform appendix. The patient made an excellent recovery, and no truss was required afterwards.

In an inguinal hernia in the male the appendix has been mistaken for the inflamed spermatic cord. It may be impossible to distinguish between a Meckel's diverticulum in a hernia and the appendix, and there is a remarkable specimen in the London Hospital Museum showing a diverticulum from the large intestine which had made its way surrounded by fat into an inguinal hernia and become adherent to the sac.¹ Meckel's diverticulum has no mesentery, whilst the vermiform appendix in about 50 per cent of cases possesses one, but in a hernia it may not be obvious (see Figs. 39 and 40). I once operated on an elderly woman with a right femoral hernia containing Meckel's diverticulum. The process was 2 inches long, had no mesentery or fat upon it, and was directly continuous above the ring with small intestine. There was no obvious reason for excising the process, and a radical cure was successfully performed in the usual way.

Instances could be quoted in which the herniated appendix has been mistaken for small intestine or for part of the bladder, if distended; for an epiplocele or for lymphatic glands if simply inflamed.

The Treatment of the Appendix in a Hernia. So long as there is no evidence of septic inflammation, it is usually safe to return the appendix after separating any adhesions which exist, and some surgeons advocate this method even if the appendix is somewhat inflamed at the time. But provided that its root can be got at and a proper excision carried out (whenever possible by the "coat-sleeve method" with use of fine silk sutures), the

¹ Even an enlarged appendix epiploica has filled the sac of an inguinal hernia (recurrent after operation for radical cure), caused reflex symptoms for long, become strangulated and gangrenous, and required herniotomy. See well-illustrated record of an unique case by Duncan C. L. Fitzwilliams in *Brit. Journ. of Surgery*, July 1922, p. 155.

best course is certainly the removal of the appendix, and this is borne out by one's belief that the appendix first protrudes in many cases when inflamed, and hence will probably remain liable to recurrent attacks.

The more serious cases where the appendix is acutely inflamed, or perhaps gangrenous, are much more difficult to deal with. If the appendix be left in the hernia a fæcal fistula may persist for long (over a year in a case recorded by Mr. Durham¹), whilst an operation undertaken to cure this fistula subsequently may prove fatal (case recorded by Hektoen²).

Septic peritonitis may spread up from the sac if the sloughing appendix has been left, whilst the return of an acutely inflamed appendix has obvious dangers illustrated by several of the recorded cases. In one unpublished case a single ligature was put round the neck of the inflamed appendix, and the stump returned, with the result of fatal fæcal extravasation. The best course to adopt seems to be :

1. If the lower part of the appendix alone is inflamed and a healthy portion can be reached by traction, it should be excised as near the cæcum as possible, and with as much care in suturing as in a formal "appendicectomy." It is doubtful if it is wise to fix the stump at the neck of the sac, since this prevents a proper radical cure of the hernia being performed. This course has, however, been frequently followed with success, and is certainly not open to the grave objections against plugging a hernial ring with omentum. The infected sac and any omentum which may happen to be present should, of course, be ligatured and excised.

2. If the appendix has become ulcerated high up at the neck of the sac (as has occurred in many cases), the danger of general peritonitis is increased, and it would seem to afford the best chance if a second incision be made above Poupart's ligament, through which removal

¹ A. E. Durham, *Guy's Hosp. Reports*, 1884, p. 435.

² Hektoen, *Amer. Journ. of Obstetrics*, 1893, p. 272.

of the appendix with disinfection and drainage may be facilitated.

3. When, owing to inflammatory adhesions, the operator has left an inflamed or perforated appendix within the hernial sac, as soon as the local condition has improved, a formal excision of the organ should be carried out and a constant source of danger thus removed.

The chief points in connection with hernia of the appendix in a femoral sac have been already touched on : its occurrence is confined to adult life, and many of the cases have been in patients of very advanced age. This is not true of protrusion of the appendix down the inguinal canal, which may occur at any age, and which presents several features deserving further consideration. Very rarely it has been met with in women : thus MM. Dujarier and Castaigne¹ record the dissection of a right inguinal hernia in a woman in which there were two sacs, one empty, the other containing the thickened and adherent vermiform appendix, partially obliterated, and forming nodosities which could be detected through the skin.

The cases in males must be divided into those of congenital and acquired origin. Mr. Bilton Pollard² operated successfully in one (in which the appendix was inflamed and was excised) on an infant only six weeks old : in one of my own cases the patient was eighty-three years of age. The latter case illustrated a point of interest : the hernia was of considerable size and contained small intestine and omentum : the swollen vermiform appendix lay in the upper part of the sac and by acting as a ball valve for some time prevented the return of the intestine.

Congenital Inguinal Hernia of the Appendix (with or without the Cæcum).—It is well known that this form may be associated with abnormalities in the development and descent of the testis. The admirable work of Mr.

¹ Dujarier and Castaigne, *Bull. Soc. Anatom.*, 1899, p. 180.

² Bilton Pollard, *Lancet*, 1895, vol. i. p. 1114.

Lockwood¹ and others has shown that occasionally peritoneal bands and even muscular fibres from the gubernaculum testis may be attached above to the cæcum, the appendix, or to the mesentery of the small intestine. I cannot, however, adduce any evidence in favour of the belief that muscular traction is an important agent in producing the descent of the cæcum or appendix into a hernia. The frequency of a connection between the descending right testis and the cæcum has been certainly exaggerated, since to judge from some authors at one period of foetal life the two are always related. From the dissection of a considerable number of foetuses of various ages my own conclusion is that in nine out of ten subjects the testis has at no period any connection whatever with the cæcum or the vermiform process. At the time the testis passes into the inguinal canal an ascending band or ridge of peritoneum usually covering the spermatic vessels will be found in about 10 per cent : its upper attachment varies ; generally it is to the under surface of the mesentery of the small intestine near to the end of the ileum ; less commonly it is to the cæcum or the vermiform appendix. In the latter case the band may go to the tip of the appendix (a case operated on by M. Lyot is figured in Clado's article on the appendix²) to its whole length, or to its root. The latter attachment seems to have been present in the case now illustrated.

The subject was an adult who had on each side the testis retained at the internal ring, and on each side a tubular pouch of peritoneum reaching to the bottom of the scrotum. Firmly attaching the back and upper part of the right epididymis to the root of the vermiform appendix was a short band of peritoneum and fibrous tissue. Death was due apparently to suppuration in the right hernial sac, which may well have started in connection with the appendix, but as the subject was one

¹ C. B. Lockwood, *Med. Chir. Trans.* vol. lxi. p. 505.

² Clado, *Soc. de Biologie*, 1892, p. 133.

obtained in the operative surgery room I could not ascertain details as to this point. A similar condition to the above may well have been present in a case briefly recorded by Sir William Osler,¹ in which a lad died from an abscess round the end of the appendix which was

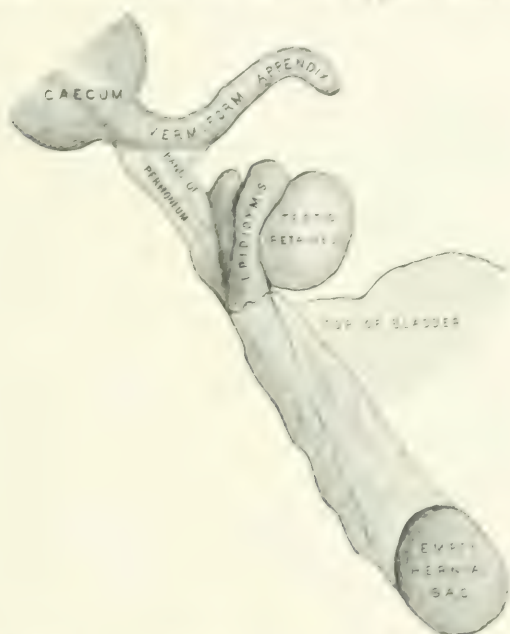


FIG. 42. — From an original dissection in the London Hospital Museum, showing a peritoneal band between the root of the vermiform process and the back of the epididymis, in a case of retained testes.

situated near the right sacro-iliac joint: the root of the appendix and the caecum were down in the sac of a right inguinal hernia, the appendix of course doubling on itself.

Occasionally when the testis is wholly retained the appendix may descend the inguinal canal and be mistaken for the former, as in a case successfully operated on by M. Tillaux;² in this case the appendix was inflamed

¹ Sir Wm. Osler, *Principles and Practice of Medicine*, 1898, p. 519.

² Tillaux, *Journ. de Méd. et de Chir. Prat.*, December 1, 1894.

and enlarged to the size of "a thumb" (and M. Tillaux's thumb was not a small one). Of quite as frequent an occurrence in the fœtus and young child as the ascending band of peritoneum already mentioned, is one which runs from the lower surface of the mesentery obliquely downwards to the right iliac fossa, limiting a pouch below the cæcum (the subcæcal fossa). The illustration (Fig. 43)



FIG. 43.—Original dissection showing how a hernia of the vermiform process (1) may occur in a pouch formed below the cæcum (3) by a peritoneal fold (2) connected above with the mesentery and below with the iliac fossa; (4) the testis at the internal ring; (5) the funicular process opened showing the gubernaculum. The condition shown in this figure is a rare one.

shows well how the vermiform appendix may descend into this fossa and perhaps even pass into the scrotum behind the spermatic cord and in a distinct peritoneal pouch from the vaginal process.

Mr. Lockwood has drawn attention to the possibility of this occurrence, and has placed a fine specimen of it in the museum of St. Bartholomew's Hospital. As in the cases of "landslip of the cæcum" into a hernia, the

vermiform appendix may come down only partially invested with peritoneum, a feature which may embarrass the operator both in the diagnosis and treatment.

In considering the occasional formation of peritoneal folds connecting the testis with the cæcum or vermiform appendix, mention should be made of the more frequent

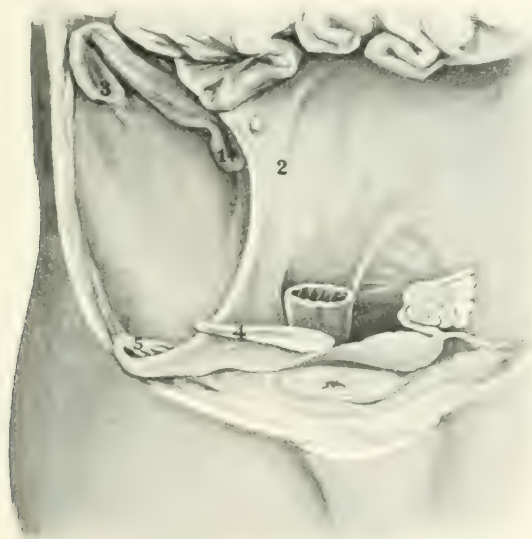


FIG. 44.—Peritoneal fold or band (2) connecting the vermiform appendix (1) and cæcum (3) above with the right ovary (4) and Fallopian tube (5). This "ligament" is not constant, but occurs in perhaps 50 per cent of subjects.

ones met with in the female sex which pass upwards from the ovary, the Fallopian tube, and the broad ligament. I believe this ascending band to be present in 50 per cent of all the subjects, and this proportion comes out in the examination both of fetuses and of adults. The ovarian vessels, like the spermatic ones, are covered by this fold, which above either ends at the mesentery (in 30 per cent out of the 50), or at the cæcum or vermiform process (in

the remaining 20 per cent). Fig. 44 shows an unusually fine example of the appendiculo-ovarian band or ligament which I happened to obtain.

On the left side of the abdomen in both sexes a corresponding band or fold of peritoneum is often present connecting the sigmoid flexure or its mesentery with either the broad ligament or the left testicle. Here one may be allowed to enter an emphatic protest against the absurd complexity which some writers have introduced into the description of the peritoneum and its fossæ. One instance will suffice. Close to the cæcum are two insignificant, inconstant, and wholly uninteresting fossæ. Will it be credited that these have already received fifteen distinct names?

Hernia of the Cæcum and Appendix on the Left Side.—The following case illustrates this unusual occurrence:

A man, aged 37, was admitted into the London Hospital with a huge left inguinal hernia, which had developed first at the age of 15. It now hung halfway down the thigh, measuring 11 inches long and 6 in diameter. It completely buried the penis, and had been irreducible for at least a year, causing much inconvenience, with occasional attacks of pain and vomiting. At the operation I found the cæcum, the vermiform appendix (which was of remarkable length), and many feet of small intestine in the sac, but succeeded in reducing them all. The sac was ligatured high up and excised, the inguinal canal being narrowed by buried sutures. The patient made an uninterrupted recovery.

This was certainly not a case of transposition of viscera, but merely an instance of wandering cæcum; no doubt both it and the ascending colon were wholly free of any connection with the right loin. I can endorse the statement of Mr. Lockwood, that this permanent persistence of an early stage of cæcal development is especially met with in "monster" fœtuses, having observed it in two full-term anencephalic ones, and also

in one with a large spina bifida. Nevertheless, it is not very rare in subjects otherwise perfectly normal, and a German writer gives the comparative frequency of right- and left-sided hernia of the cæcum and appendix as being 72 and 28 per cent. The latter number is certainly over the mark.

Lenander has recorded the dissection of a lad, aged 16, in whom the cæcum lay against the spleen, the appendix measuring 9 inches, which is practically a record length.

The vermiform appendix is, of course, frequently met with in an umbilical hernia, especially in the congenital form. In one remarkable case in an adult recorded by M. Tuffier,¹ it described a semicircle at the neck of the sac, and was the actual cause of strangulation.

Finally, it may be noted that the appendix, although normally placed within the abdomen, may cause infection and suppuration in the sac of an inguinal hernia situated immediately below it. This complication is of particular interest with regard both to diagnosis and treatment: two examples of it occurred in the London Hospital in one year.

HERNIA OF THE BLADDER

It is of interest that attention was called to this subject by a number of surgical writers so far back as the eighteenth century. M. Verdier² published a good monograph on it in 1753. MM. J. L. Petit, Méry and others in France, Monro and Sharp in this country added further observations. Of late years Krönlein, Guterbock, Ebner, Monod and Delagenière, Brünner, Eggenberger and the writer have increased the list of recorded cases.

Pathology.—Hernia of the bladder has little to do with any congenital pouch of peritoneum, it is almost

¹ Tuffier, *Arch. Gén. de Méd.*, 1887.

² Verdier, "Recherches sur la hernie de la vessie," *Mém. de l'Académie Royale de Chirurgie*, t. iv, p. 3.

invariably acquired—usually in late adult life.¹ Instances are, however, met with in boys.

Cases have been met with of its protrusion through the pelvic diaphragm (the levator ani) into the perineum (Astley Cooper, Jacobson, Hartmann and others); it has been seen as a great rarity in obturator hernia. With the mention of these possibilities we will pass to the more frequent cases—and the only ones of importance to the radical cure of hernia. These are either inguinal (practically confined to men) or femoral (chiefly in women).

Three conditions favour the entrance of part of the bladder into a hernial orifice: (1) Dilatation with thinning of the muscular wall so that a pouch or saccule is readily developed; (2) overgrowth of fat under its peritoneal investment which leads to a fatty hernia, and later to protrusion of a small part of the bladder itself—these are the most dangerous and deceptive cases for the operator; (3) firm adhesions between omentum and lateral aspect of bladder close to a hernial ring—further descent of omentum draws down the bladder with it. The first two are undoubted causes, the third (in which the pouch will be covered by peritoneum all round it) is vouched for by Berger and Leroux.

It is obvious that vesical hernia may be primary, *i.e.* the pouch alone projects through the ring (I think always the femoral one in this case) *and may be entirely or mainly devoid of a sac*. Or its occurrence may be secondary to an ordinary hernia, inguinal or femoral, but chiefly the former, into which the intestine and omentum have first descended. Here a fat-covered swelling or thickening of the sac is found on operation, perhaps a considerable cyst-like lump. This usually projects on the inner wall, and its peritoneal investment is incomplete. As already

¹ Note that vesical hernia sometimes is purely extra-peritoneal, there is no sac at all. By far the most frequent variety is the para-peritoneal when only part of the protrusion is invested with a serous covering. It occurs especially in herniæ with large orifices, and more frequently in men than women (Coley says the proportion is 7 to 1, but this cannot be true).

noted, the omentum may adhere closely to it, thus adding to the difficulty of recognition and dissection. As the hernia increases in size and descends, an elongated pouch is drawn out, and the opening into the main vesical cavity becomes quite small. Perhaps from this circumstance the deposit of urinary salts in such a pouch has led to the formation of calculi within the herniated pouch.¹

Now and then the pouch has been so large that pressure from the groin was required to empty it: again it has been possible to distend it by injecting water through a catheter.

It is the anterior or antero-lateral portion of the bladder that forms the pouch, very rarely the fundus, or even the great bulk of the organ. The latter occurrence will seem incredible except to those surgeons who have observed the remarkable lateral mobility which a bladder, habitually distended, may assume in a thin elderly subject. Whilst it is true that the herniated bladder is sometimes thin-walled and comparatively destitute of muscular coat, yet in many cases the muscle is sufficiently obvious to provide an admirable clue to the operator as to the nature of the swelling. It may be said that any thickening of the hernial sac, which on careful dissection *is found to have a muscular structure, is sure to be the bladder, and the operator should refrain from opening it.* The fact of a cystic swelling being incorporated with the sac wall does not of necessity mean that it is a hernia of the bladder. When operating on a large irreducible right inguinal hernia I was in much doubt as to such a

¹ Cases reported by Gross, Percival Pott, and others. Van de Wiel observed two in which the stones worked out through the groin! J. L. Petit one in which several small calculi were pressed back from the hernia into the bladder and ultimately escaped by the urethra. I have not yet heard of their recognition *in situ* by the X-rays, but no doubt it will be effected, although in most cases hernia of the bladder remains unsuspected before the actual operation. In fact, as an American writer puts it, "pre-operative diagnosis is made with chagrinning infrequency." "Chagrinning" is an expressive term, not yet in any English dictionary.

cyst, which bulged from the inner wall of the sac and extended up into the canal—there was no sign of muscle beneath the peritoneum which partly invested it—nor did it by other tests appear to communicate with the bladder—so it was incised, letting out several ounces of straw-coloured fluid! Nevertheless it proved to be an adventitious cyst which was safely removed with the rest of the sac and the radical cure completed.¹

Symptoms and Diagnosis.—The symptoms of hernia of the bladder are as a rule “conspicuous by their absence”; it is only when the pouch is large, when cystitis occurs in it, or when it causes reflex bladder trouble that suspicion is likely to be aroused. Here comes in the real importance of the subject—the presence of a hernial pouch leading into the bladder is first discovered on operation—perhaps *after it has been incised and urine escapes from it*. This accident, a real trial to the nerves of an operator, happened to me on one occasion. I sutured up the opening very carefully, but a small fistula resulted which ultimately closed. In several other instances I have recognised the bladder wall in a hernia in time, and returned it within the abdomen. That this accident, *i.e.* opening into the herniated bladder, is not very exceptional is shown by a list of over 100 such cases having been collected from the practice of various surgeons. Even if the operator discovers his mistake the prognosis is rather serious, many patients having died as a result. But the worst occurs when the pouch has been ligatured, twisted, or incised during a herniotomy without recognition at the time.

Mr. Edmund Owen, with fine candour, brought forward a case in which he had twisted and ligatured a hernial sac, and in so doing had inadvertently removed part of the bladder wall—with a fatal result.

¹ In this case there was also a “landslide” of the cæcum. Altogether the operation was one of the most puzzling and difficult any surgeon could have to perform, and it occupied over two hours. Yet before commencing it no special trouble had been anticipated, the case being regarded simply as an ordinary one for radical cure. The lesson is obvious.

The discussion on this case which followed at the Medical Society of London was of much interest as proving that whilst torsion of such a pouch might be very rare several speakers had met with cases of its being wounded.¹

The possibility of twisting the pouch has been used as an argument against employing torsion of the sac in radical cure taken as a whole, though hardly with justice.

In dealing with femoral hernia torsion of the sac is unnecessary and not often practised—this rules out most subjects in which hernia of the bladder is likely. In inguinal hernia the fingers of the operator's left hand should make certain that they are holding nothing but the sac before the latter is twisted and the needle thrust through its neck.

One word in conclusion -if the surgeon meets with a suspicious lump in the sac-wall the test of filling the bladder through a catheter may settle the diagnosis, though a much narrowed communication may prevent it being conclusive.

¹ Alessandri has published a list of 147 cases of herniotomy in which the bladder had been unexpectedly found in the sac wall, and in *no less than 136 of these it was accidentally opened*.

CHAPTER VIII

STRANGULATION : PATHOLOGY, SIGNS, AND SYMPTOMS

STRANGULATED HERNIA

BEFORE discussing the all-important complication of hernia known as strangulation, we have to note three conditions which may favour its occurrence or be mistaken for it.

1. The first is, **Inflammation of the Sac and its Contents.**—The mildest form of this, giving rise to neither local signs nor general symptoms, results in adhesions between the sac and contained omentum or, less commonly, intestine. The ease with which the great omentum, either within the abdomen or in a hernial sac, fixes itself to another peritoneal surface, is remarkable and difficult to explain. In the case of a hernia, the most frequent adhesion is the end of the omental tag to the bottom of the sac, but we may find it glued along its edge or fixed in annular form to the neck of the sac. Once the omentum has adhered to the sac, the hernia *ceases to be reducible*; moreover, there will be a steady tendency for it to increase in bulk, partly by drawing down more omentum, partly by a local hypertrophy of fat.

How often has the practitioner laboured in vain to reduce a hernia by taxis and found on subsequent operation that the sole cause of its irreducibility was a firm omental adhesion!

What may be termed mild adhesions between intestine and sac or omentum are fairly common, especially, perhaps, in the region of the neck of the hernia. Re-

peated slight trauma, due to taxis or the pressure of a truss, is probably responsible, aided by the bacilli of the intestine. Where the operator finds a loop of gut widely adherent to the sac, blending, in fact, with it, a local enteritis, due to abnormal contents¹ or an attack of strangulation which has passed off, may be invoked as the cause.

In the section on Hernia of the Vermiform Appendix, we have seen how often even suppurative inflammation has come on in cases involving this organ.

As a result of trauma, such as a direct blow on a hernia containing intestine, or a very badly fitting truss, etc., peritonitis may be set up, which spreads to the abdomen, and may prove fatal.² Con-

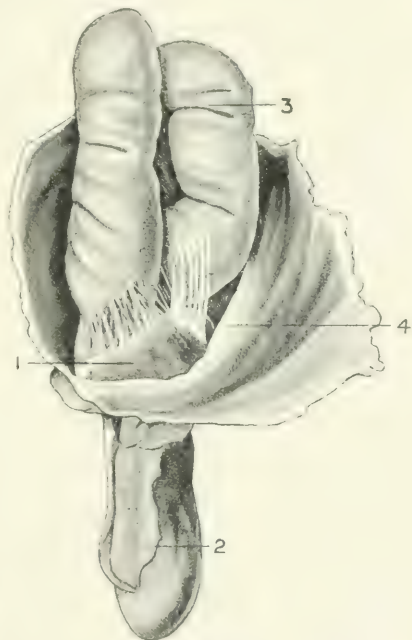


FIG. 45.—Inguinal hernia, in which a loop of small intestine (3) is firmly adherent to the bottom of the sac (4) which is seen to be drawn upwards at (1) by traction on the intestine. (2) The testis. (Scarpa.) Such acute-angle kinking of intestine in the hernia might cause obstruction (quite apart from strangulation).

¹ See an interesting specimen in the R.C.S. Museum of sac adhering to inflamed intestine within it, the latter full of undigested potato-peelings. Both sac and intestine had been pushed within the abdomen (mass-reduction).

² A labourer received a kick over a right inguinal hernia; severe collapse ensued. When admitted some hours later, I operated, finding an empty but inflamed sac; the inguinal canal was large. There had been no rupture of intestine. In spite of drainage, etc., the case ended fatally from general peritonitis.

sidering how defective and inefficient many of the trusses worn are, or become in the course of time, it is remarkable how seldom such serious complications occur.

Inflammation is most commonly met with in large umbilical herniæ, sometimes in femoral epiploceles. With the local signs—heat, tenseness, and pain—occur rise of general temperature, malaise, and perhaps sickness. Though actual vomiting with constipation may be present, an impulse on coughing seems to negative the diagnosis of strangulation.

Although under treatment by low diet, cold applied to the hernia, etc., the inflamed condition may subside, yet it is usually wise to operate without waiting, as it is very hard to be certain that some part of the hernial contents is not nipped.

The impulse on coughing is of little value as a test in femoral hernia.

2. Irreducible Hernia.—With regard to the onset of irreducibility in a hernia, we are naturally biassed by the patient's statements—which are sometimes incorrect. For example, if a man with a large inguinal hernia states that he has been able, on lying down, always to reduce it by taxis completely, but that for twenty-four hours it has been quite irreducible—so long as there is still a good impulse on coughing and an absence of nausea, vomiting, abdominal pain—the practitioner may fairly try the effect of posture and his own taxis. The posture referred to—head the lowest part, foot of bed raised considerably—is most useful in treating both children and adults. The inclination of the trunk approaches that of the Trendelenburg posture, its effect being to draw the intestine away from the sac, provided it is not nipped. Ice-bags applied in addition are of undoubted effect, and in former days many and many an irreducible hernia, in which even signs of commencing strangulation had appeared, were reduced with ease after an hour or two's application of ice, posture, followed by careful taxis.

Such a course is still advisable in some cases, provided

the irreducible hernia *is not tense*, but if the circumstances allow of operation for radical cure being properly performed, no time need be lost in resorting to it. *Tension* in the hernia, if irreducible, is the most vital and important sign. Nowadays it points to immediate operation, as, even if no strangulation is found, the radical cure can be carried out more satisfactorily than if that condition were awaited.

If a hernia has been totally irreducible for long, the operator must expect to find some complications within the sac: of these, adhesions are by far the most frequent. Fortunately "landslide" of cæcum or sigmoid is rare. In one case of inguinal hernia I found coils of intestine free from adhesions, but impossible of return, owing to a large fat-laden vermiform appendix acting as a ball-valve in the upper part of the sac.

Irreducibility in a hernia, whether temporary or permanent, points directly to operation for radical cure.

3. Obstructed Hernia.—The best idea of this condition will be conveyed by the term "intestinal stasis within a hernial sac." Formerly the word "incarcerated" was used to imply that a hernia was not only irreducible, but that the passage of its contents was arrested. Incarcerated literally means only imprisoned, and as applied to a hernia would be the same as irreducible: the use of this term should therefore be abandoned.

Granted that loops of small intestine within a hernia may become kinked by adhesions, or hindered as to their peristalsis in a very large one by sagging down (just as occurs occasionally in the pouch of Douglas within the abdomen), yet the contents of the intestine are so soft that absolute obstruction or stoppage of this part of gut in a hernia is very uncommon, *except from actual strangulation*. Hence some have gone so far as to deny the possibility of "obstructed or incarcerated hernia"¹ as a

¹ The confusion of terms is at least a century old—thus in Wishart's translation of *Scarpa on Hernia* it is stated that "incarcerated and strangulated hernia have clearly a different signification, though both

separate entity. But that true intestinal stasis can occur in the *large* intestine without any mechanical cause is a matter of everyday experience, and the looping of this part of gut in a hernia will especially favour it.

It is therefore in umbilical and left inguinal herniæ that obstruction—apart from strangulation—is met with, constipation and discomfort (possibly slight sickness) being the symptoms, with increase in bulk of the irreducible hernia. There should be a free impulse felt and no tension, otherwise the condition is one of strangulation.

It is quite likely that masses of fæces can be detected on palpation, with the typical doughy feel.

Here again we see the strong connection that exists between habitual constipation and hernia; the former often leads to the latter, and the presence of a hernia is apt to induce constipation.

We must grant that such a condition as obstruction (*i.e.* intestinal stasis or blocking) within a hernia can, and does, occur, apart from mere irreducibility and apart from strangulation; but also that it is practically confined to herniæ containing large intestine, that one condition may lead to the other, and that erroneous diagnosis has in some cases led to fatal postponement of operation. The surgeon is here in a dilemma. A true obstructed hernia is not at all suitable for radical cure—at that moment—especially considering the type of patient that is its subject. On the other hand, the old rule as to cases of suspected strangulation, “When in doubt, operate,” is, generally speaking, a sound one.

terms have been used indiscriminately. For in incarcerated hernia the course of the fæces is interrupted, without any *considerable injury* of the texture and vitality of the intestine,” etc. “This distinction is proved by practice. The intestine which has been simply *incarcerated*, recovers its action immediately after being replaced in the abdomen; the strangulated intestine never recovers it.” (*Scarpa on Hernia*, 1814, p. 295). It is obvious that to some of our ancestors an incarcerated hernia was one in which the degree of strangulation was not so severe that it could not be recovered from. So employed the term was a thoroughly bad and misleading one.

In cases such as have been precisely outlined above, where there is a good impulse, where the hernia is not tense, where the characteristic vomiting is absent, it will be best to try the following measures: (1) Elevation or support of the hernia, combined with gentle taxis, repeated at intervals: (2) free enemata, injected as high up as possible; and perhaps (3) the hypodermic injection of pituitrin or eserine.

Most careful watch should be kept on the patient by the surgeon for the next few hours. If by this time the hernia has become smaller and no vomiting has occurred, all will be well. If, however, the hernia is more tense, if the enemata have had little effect, and if the tendency to sickness increases, then the operation—no matter with what reluctance and at whatever hazard—must be done without further delay.

It may be asked, Why should not aperients be given by the mouth? The consensus of opinion is against this for three reasons: they may easily cause vomiting, enemata will act more quickly on the large intestine, and enemata are harmless if strangulation should be coming on (which, of course, aperients are emphatically *not*).

Few conditions will cause the surgeon more anxiety than "obstruction" of a large irreducible hernia in a fat elderly patient—with probable degeneration of important viscera, such as liver, heart, and kidneys.

STRANGULATED HERNIA

The Pathology and Symptoms of Strangulation.

—The following definition, made long ago by Gosselin, needs but little alteration. "Strangulation of an enterocele or an entero-epiplocele is a constriction of the intestine within the hernial sac, a nipping which hinders or stops the circulation of blood, arrests the passage of the intestinal contents, prevents reduction of the hernia, and threatens to terminate in perforation or gangrene of the gut."

It should be added that a lump of omentum alone in the hernial sac may be strangulated and produce symptoms differing only in degree from those due to nipping of gut.

Further, that although in the great majority of cases the strangulation occurs at the neck of the sac (internal inguinal ring, femoral, or umbilical aperture), it occasionally is produced lower down in inguinal hernia, and in either form an omental band or constriction, wholly within the sac, may be the cause of strangulation. Sharp kinking of intestine within the sac, due to adhesions (see Fig. 45, page 203), may cause obstruction, though not true strangulation, in which the circulation is arrested, as well as the passage of contents.

Is it possible for strangulation of gut to occur without complete interruption of the peristaltic flow? If so, it happens only in the rare examples of Richter's or Littre's hernia, where the whole lumen of gut is not involved within the constriction. However, some of these cases are both rapid in progress and attended with symptoms of complete intestinal obstruction.

A lady, in previous good health, was seized with attacks of vomiting and abdominal pain, attended by constipation. She was treated by her doctor on the erroneous diagnosis of "gout in the stomach," and it was only when she was moribund on the third day from the onset of the vomiting that a surgeon was called in. A very small tense femoral hernia was then recognised, but it was too late to operate. I obtained a post-mortem, which revealed a Richter's hernia, a small portion of the calibre of the ileum being tightly nipped in the femoral ring. The lumen of the gut was hardly interfered with, but the obstruction symptoms had been as severe as in the ordinary cases of strangulation of a complete loop.

Richter himself contended that the form of hernia to which his name has been given (partial enterocele or lateral nipping of a piece of intestine) was likely to go on

to gangrene with special rapidity ; he instanced one case in which this ensued within eight hours of the onset of strangulation. But it is doubtful if this view is correct.

One is too apt perhaps to regard strangulation of a hernia as a sudden event in all cases, and its effects on



FIG. 46.—Partial enterocoele (Richter's hernia). At the neck of the sac (1) of an inguinal hernia (2) a single loop of small intestine is engaged. Strangulation of only part of the circumference of the loop has occurred. Below are seen the testis and coverings of the cord. (After Scarpa.)

the contained intestine to be of equal intensity. This is by no means the case. Much depends on whether the constricting agent is a narrow inextensile ring or a real canal with thickened neck of sac and surrounding tissues. A small aperture, *e.g.* the femoral ring, with a sharp edged Gimbernat's ligament, may produce strangulation of the most intense form in a few hours ; the same is true

of a congenital inguinal hernia into which a loop has suddenly been forced for the first time. On the other hand, an old inguinal or umbilical hernia with widely stretched rings may become the site of strangulation of a gradual or even intermittent type.

In one case (the patient being an old woman with a hernia of considerable size) that I knew of, there were signs and symptoms pointing to strangulation which lasted twelve days, at the end of which long time she died. The surgeon had been deceived by the complete absence of vomiting in this case, and had hence refrained from operating. The cæcum was found in the sac and had undoubtedly been nipped for the whole period. Such a case is very exceptional, but in the history given (especially perhaps with large herniæ which have been only partially reducible) we find sometimes evidence of attacks of strangulation which were recovered from. Thus of 250 patients operated on by Berger for strangulated hernia he found such evidence in 23 (*i.e.* nearly 10 per cent).

Speaking generally, strangulation in a hernia is marked by sudden onset, its symptoms become steadily worse unless operation is performed, and the fatal issue (which also may be of tragic suddenness) occurs within a very few days. A deceptive lull or improvement is occasionally noted, especially as regards pain and vomiting, should perforation or gangrene of the gut occur—obviously due to relief of tension. But this is by no means always the case.

Is severe strangulation ever recovered from, apart from return of the obstructed intestine by operation or successful taxis? Undoubtedly it is, though very rarely.

Sir Frederick Treves and I each observed one instance of this. Both patients, a man and woman, after admission to the London Hospital obstinately refused permission for operation. Their herniæ went into gangrene, fæcal fistulæ persisted for a considerable time, but ultimately in both cases healed up. In a long ex-

perience these were the only two such cases noted, but many others could be adduced from surgical records.¹

Mechanism and Effects of Strangulation.—It is possible for a mass of omentum, forming the sole inmate of a hernial sac, to become nipped and to give rise to the typical symptoms. Lord Lister stated that even the constriction of subperitoneal fat (lipoma in a hernial region) might cause them.²

We have here no question of arrest of intestinal flow, there is another factor—the irritation of nerves supplying the peritoneum. This must be present in every case of true strangulated hernia, and helps to explain several features: for example, the severe shock or collapse at the onset which is sometimes seen, the reflex vomiting, the pain referred round the abdomen, the small hard pulse, etc.

Tight strangulation which paralyses the nerves will favour gangrene in the gut below, and even where the pressure has been relieved by early operation before there is any sign of gangrene, may prevent the returned intestine from recovering normal peristalsis. It is certain that such damage to the nerves is responsible in some degree for the mortality following strangulated hernia.

Most herniæ contain both intestine and omentum; the effect of nipping will be far greater on the former than on the latter. The ileum being thinner walled and less vascular than the jejunum will prove less resistant when strangulated. Unfortunately it is the former that is most often involved in a hernia.

¹ Sir Wm. Macewen had an extraordinary case of recovery in a woman whose strangulated loop of gut had ruptured (both ends of the loop) with consequent flooding of the abdomen with faeces. The abdomen was cleaned out, the two ends of the loop drained, and ultimately united by suture. For several days after the first operation the patient lay unconscious, almost pulseless, and apparently moribund. (Personal communication to the author.)

² See also the note (p. 189) on strangulation of an appendix epiploica, merely fat surrounded by peritoneum, which may produce serious symptoms.

The injurious action of the bacillus coli is also greater the lower the level of the gut affected.

The effect of strangulation on the mesentery should not be ignored, thrombosis of its vessels and adhesive inflammation being two well-known results.

We see therefore that the mechanical effects of strangulation are complex, including (1) arrest of passage of intestinal contents (with rapid putrefactive changes due to bacilli, and distension with gas of the loop involved) ; (2) arrest of circulation, first in the veins, then the arteries, with the consequences thereof ; (3) severe irritation and later paralysis of the sympathetic nerves involved in sac and contents ; (4) injury to the coats of the intestine, leading to perforation or gangrene (this will be discussed later) ; and (5) damage to the vessels and nerves in any contained mesentery or great omentum. The damage done by bacillary action to the injured sac contents is of the greatest importance.

How is strangulation—which is now admitted to occur almost invariably at the neck of the sac and the point of exit from the abdomen—actually produced ? The abdominal muscles have not much to do with it—except by forcing intestine through the ring (*e.g.* in coughing or straining at stool), though it has often happened that taxis has readily succeeded under a general anæsthetic where it failed before.¹

There are two chief ways in which it develops. First, by a straining effort the gut is forced into a hernial pouch which had previously been empty (or potential) ; this is

¹ This occurs especially in inguinal and umbilical hernia ; in the femoral variety the tightness of the ring cannot be influenced by muscular contraction, although complete relaxation under a general anæsthetic prevents the patient straining hard as soon as taxis is attempted, and thus preventing the return of the hernia.

In the section on interstitial hernia (p. 118) it has been noted that Tillaux was convinced that contraction of the transversalis and internal oblique directly caused strangulation. Otherwise we should say that muscular spasm is rarely responsible for this, though it hinders return of the hernia during taxis.

especially seen in congenital hernia of young adults and in femoral hernia where the ring is small and cannot stretch. Second, into a hernia—irreducible for long and perhaps entirely composed of omentum, a loop of gut is suddenly driven. This type is more important than the first: in both it will be readily pictured how the neck becomes too tight for its contents.

There are at least two rarer methods: the intestine and omentum which have been harboured in the sac without causing much trouble become obstructed or inflamed, perhaps owing to a badly fitting truss; the consequent distension with gas of the gut causes strangulation at the neck.

Finally, a band formed by adherent omentum, or an aperture in this membrane may constrict a loop of intestine within the sac, quite apart from any tightness of the sac itself. This form of obstruction is certainly rare and occurs chiefly in large umbilical or ventral hernia, though not unknown in inguinal.

In the ways mentioned above it is easy to see how strangulation commences: more difficult to explain perhaps are its rapidity and deadly effects on the contents of the sac. At any rate much ingenuity has been spent in the attempt to explain them, and many theories advanced.¹ For the most part these have been too purely *mechanical* and have ignored a physiological factor which to my mind removes any difficulty in explaining the phenomena of strangulation.

At the very onset of strangulation the irritation of the nerves causes peristalsis which wedges the intestine more tightly into the hernial orifice, and in the loop or loops below the constriction gaseous distension occurs with the rapidity we are familiar with in most cases of intestinal disturbance apart from hernia.

¹ These include torsion of the intestinal loop, production of valvular obstruction by the mucous membrane, compression of one side of the loop by the other—to mention three only of the somewhat far fetched and improbable theories advanced by Roser, Kocher, de Roubaix, etc.

The more the distension below, the tighter becomes the nipping above ; hence the complete vascular obstruction and in many cases the rapid advance to gangrene.

In the interesting cases of strangulation in which the symptoms are ill-marked and gradual (cases only too apt to be mistaken in practice) probably the gut involved is high up, *i.e.* jejunum with good muscular wall, and does not so readily distend with gas.

The extraordinary tension of the strangulated loop, and its complete subsidence when the stricture is divided, will be familiar to every operator.

So rapidly does strangulation come on that it is said 20 per cent of the cases coincide with *the first descent of the hernia*. This is probably an over-estimate, as in the inguinal region and still more in the femoral a small hernia may pass for long wholly unperceived by the patient—it is only when nipping of the contents occurs that his attention is aroused !

A few words as to the incidence of strangulated hernia will not be out of place. Cases are equally common in the two sexes ;¹ now, hernia as a whole is far more frequent in males—the inference is clear that women are in this matter more timid or more careless than men and allow their herniæ to be treated with trusses, or to be wholly neglected, rather than submit to operation for radical cure. My own experience agrees with that of most surgeons : in women operations for strangulated hernia have actually been more numerous than those for simple radical cure ! This is a matter which calls urgently for improvement.

Strangulation is rare before full adolescence is reached, after that it is met with up to extreme old age.

Sir T. Holmes, with his special and long experience of the surgery of childhood, declared that he had never been called on to operate on a case of strangulated hernia in Great Ormond Street Hospital. However, I can personally recall this complication occurring in an um-

¹ Several authorities make females preponderate.

bilical hernia in an infant soon after birth, as well as in more than one inguinal hernia in boyhood, etc.

M. Charles Féré collected records of 56 cases in children, chiefly boys under two years. These were mainly examples from the Paris hospitals. Schmidt in Germany collected 64 cases operated on in childhood with 43 recoveries. Note the heavy mortality (33 per cent): this is doubtless in part due to the actual rarity of such cases—when they do occur they are not diagnosed until it is almost too late.¹ (See also p. 257.)

In adults, especially elderly subjects, strangulation is particularly apt to occur during a spell of cold wintry weather. Two reasons may be given for this: it causes abdominal congestion and intestinal disturbance, and it increases any tendency to bronchitis, etc., which may exist in the subject of hernia. On one very cold night I was once summoned to the hospital to four cases of strangulation admitted in succession within an hour or so of each other!

That most operations for strangulated hernia are required during night-time depends on the psychology of the patient and still more of his relations.

We return to consider the pathological changes due to strangulation, the signs and symptoms produced by it: they are so interwoven that it is best to take them together. For the sake of clearness it is supposed that a single loop of intestine has become nipped.

1. The loop becomes distended with gas, increasing the effect of the constriction, making the hernia tense, and stopping any impulse on coughing.

There is irritation of the nerves of the sac wall and intestine, hence pain about the hernia and referred higher up (especially to the umbilical region supplied by the tenth dorsal nerve). Hence also reflex vomiting or at any rate nausea, with more or less shock.

¹ It should be noted that one cardinal symptom of strangulation, namely, vomiting, is of small significance in childhood compared with adult life.

2. Circulation in the loop is obstructed, first the venous return of blood and then the arterial; hence œdema of the wall with change of colour ranging from purple-red to black with transudation of blood-stained serum into the sac, hence also hæmorrhages into the submucous and subperitoneal layers of the intestine.

Bullæ containing blood may form beneath the outer coat of the intestine or small abscesses from invasion by bacilli, etc. Œdema in the tissues around the sac may mislead the operator when dissecting carefully down to it.

So far, even though the loop be coal-black, there is good chance of recovery after operation, provided the gut is still resilient and neither perforated nor deeply ulcerated from within.

3. The complete vascular obstruction, combined with destruction produced by the bacilli and their toxins, or by the trauma of pressure against a sharp-edged ring, after a variable time ends in gangrene or perforation.

The sites of greatest danger are opposite the neck of the sac (especially in the afferent or upper end), and the convexity or lowest part of the loop—for obvious reasons. In the first position a linear ulcer starts in the softer and less resistant mucous membrane and eats through to the peritoneum. This danger zone, especially in femoral hernia, should invariably be examined by the operator (after dividing the stricture) before he allows the loop to return into the abdomen.¹

Grey sodden patches on the convexity of the loop, with a complete loss of resiliency (compared to wet blotting-paper), and a fæulent smell in the sac-fluid, are conclusive evidence of gangrene—a loop in such a condition *should never be returned*.

There are several other lesions which must be noted,

¹ If the loop is a small one or if the case is one of Richter's hernia, it may readily happen that the intestine slips up directly the hernial ring is enlarged and the tension released, before the operator has been able to examine it. Should he decide to do so through an incision above Poupart's ligament, the affected loop will always be found lying near to the hernial ring.

especially those due to bacterial action and putrefactive change in the contents of the loop. Patches of lymph may glue the intestine to the sac, or one side of the loop to the other: stercoral ulcers may form above the site of strangulation (perhaps for several inches in the dilated proximal portion): the sac itself may be acutely inflamed, or even infected with gangrene.

The bacillus coli, as in acute appendicitis, has been shown to be the chief micro-organism that causes disaster: there is no doubt that in the hernial contents and fluid it rapidly increases in virulence and destructive power. In the early stage it has been shown to swarm in the gland tubes of the intestine, later to invade all the coats, whilst the fluid in the sac teems with it. Nor is this the worst—for in many cases of strangulated hernia the blood is infected with the bacillus, and secondary inflammation of lungs and spleen especially are only too common (see Figs. 47 and 48).

Other micro-organisms have been found with this bacillus, some of comparatively small importance: they include two varieties of streptococci.

The role played by these germs (especially the bacillus coli) in connection with strangulated hernia in late—*i.e.* neglected—cases can hardly be exaggerated. It has been made clear by the work of Nepveu, Garré, Bönnecken, and especially Clado of Paris.

Their virulent cultures help to produce gangrene of intestine wall, acute enteritis, ulcers, and general peritonitis. They lead to failure after excision of gangrenous gut (especially if the operator has been too timid as to removing enough to reach healthy intestine), they are responsible for the low form of pneumonia which carries off many patients after operation, and partly for the toxic absorption which is so pronounced a feature.

One practical point in connection with them is that during the operation both the sac and the intestinal loop should be thoroughly cleansed with warm sterile water before the latter is returned, all infected omentum excised,

and finally the sac itself removed as part of the radical cure.

In judging the state of the bowel involved in the sac the condition of the fluid is to some extent a useful guide.

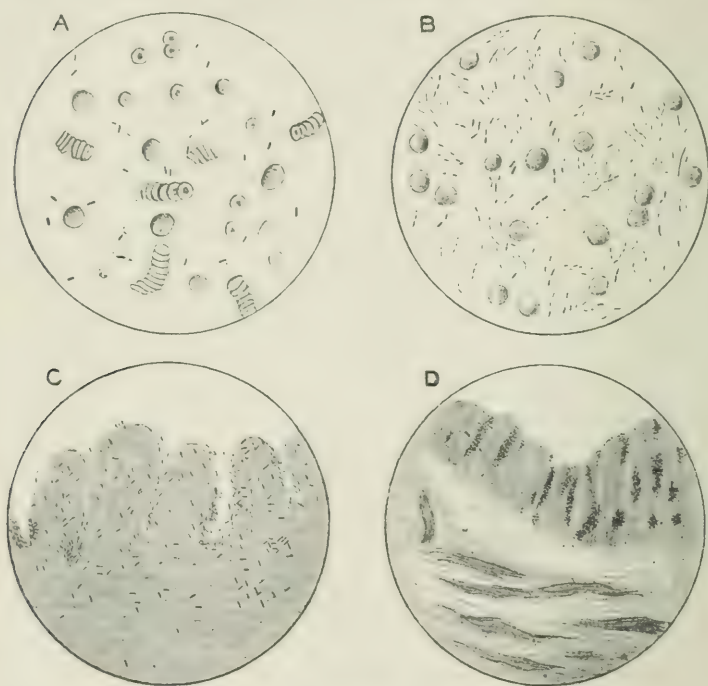


FIG. 47.—Local infection with the *Bacillus Coli* in strangulated hernia. A, Fluid in the sac, red and white blood corpuscles with bacilli. B, Peritoneal fluid with white corpuscles and bacilli. C and D, Section of the wall of the strangulated small intestine, the tubular glands of which are packed with bacilli, the latter also infiltrate the outer coats. (After Clado.)

the absence of odour, lymph, or blood being favourable signs. In one exceptional case I found the sac of a femoral hernia full of castor oil which had escaped through a perforation in a small knuckle of strangulated gut! The oil had been administered by the practitioner, as

Dr. Johnson would have said, "in sheer ignorance" of the nature of the case.

Strangulation of a hernia (apart from exceptional cases) involves intestinal obstruction, with its cardinal symptoms of vomiting and absolute constipation. But of these two the vomiting is by far the more important; indeed the surgeon who attached much importance to the history of constipation or absence of such in a case of hernia might be misled, with fatal consequences. There are two reasons for this—first, the onset of strangulation with its reflex irritation of the splanchnic system causes colicky spasm above the hernia and possibly below as well—at any rate there may be an attempt to pass fæces which partially succeeds, though affording no relief. Or an enema may have had some result. Secondly, the patient may have had a free motion shortly before the onset of strangulation and twenty-four to forty-eight hours may see irreparable damage done to the gut, although no one could say constipation existed in such a case.

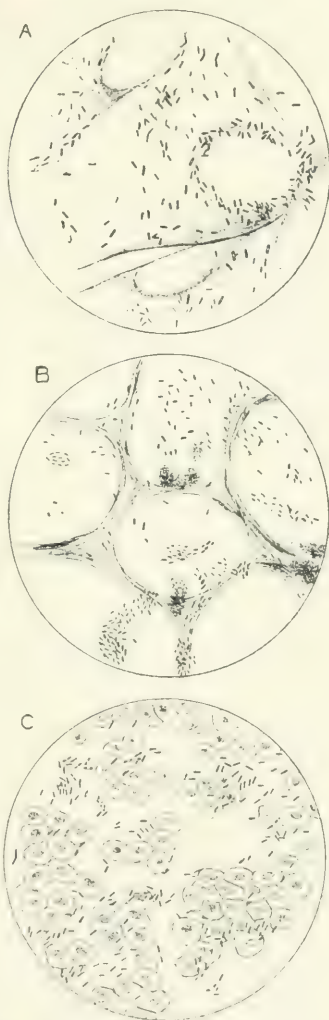


FIG. 48. Infection of distant organs by the *Bacillus Coli* derived from a strangulated hernia. A, Tissue of spleen. B, Lung. C, Liver. (After Clado.)

It is a mistake that stress has been laid in many writings on constipation as a sign of strangulation of a hernia—the diagnosis should be made entirely apart from this.

The symptom of vomiting stands on a different plane. It not only occurs soon after strangulation has set in (one of the earliest signs), but in unrelieved cases occurs again and again, until the fluid (thrown up in remarkable quantity) has a horrible fæculent odour and colour. The sudden expulsion of pints of this stuff, vomited perhaps without any straining effort, if once witnessed will always be associated with intestinal obstruction and particularly with hernia cases.

Towards the end the patient may be suffocated by this vomit.

Tension or hardness in a hernia (in most cases loss of impulse), conjoined with vomiting, are on the whole the two most valuable signs—and if both are present operation should not be delayed for an hour.

It is extremely rare for vomiting to be absent entirely (on this point see p. 210), but sometimes in neglected cases it stops and is replaced by hiccough, etc., presumably because everything in the gastro-intestinal tract has been brought up.

Once again I would urge the importance of remembering how foul stuff collects in the stomach in cases of strangulated hernia, and what relief may be afforded by washing the organ out as a preliminary to the operation (see pp. 234 and 238).

As regards the condition of the abdomen with strangulated hernia, one's impression is strong that distension is rarely met with except in the last hopeless stage, when peritonitis has supervened, or when exhaustion is prelude to death.

There may be moderate rigidity—not the board-like hardness of purulent peritonitis, etc.—with colicky as well as constant pain. The pulse, as in all cases of peritoneal irritation, becomes small and harder than normal. There

can be no need to repeat the classical description of the "abdominal expression of face," nor to refer to changes in the urine occasionally noted (albumin, sugar, indican, etc.). It is, however, worth recording that in young children retention of urine seems to go with strangulation of intestine in a considerable proportion of cases,¹ and the same may be seen in adults.

There is a local test which is usually mentioned, but which to my mind is perfectly valueless—namely, the presence or absence of dulness on percussion over the hernia. A strangulated hernia, whatever the contents of the sac may be, will always give a dull note, so would many non-strangulated ones. If resonance *were* present it would not matter in the least, so far as diagnosis and treatment are concerned.

I have tried, at the risk of wearying the reader with a good deal that has been described in other books, to convey the complexity of the subject, as regards the pathology. We have seen that all these factors are usually present in a severe case of strangulated hernia: (1) obstruction to the passage of stuff along the intestine, usually at a point in the ileum, which continues to be as completely blocked as if it had a band twisted round it: (2) irritation and later paralysis of visceral nerves, causing important reflex symptoms and perhaps preventing recovery of tone in the loop (apart from gangrene): (3) venous and arterial obstruction, sometimes thrombosis, with their well-known results on the vitality of the gut: (4) traumatic damage by pressure of a tight ring, taxis, etc.: (5) septic invasion of the contents by the bacillus coli which may become of extreme virulence: (6) changes in the gut above—especially dilatation and inflammation of the wall for some little distance, perhaps stercoral ulcers.

With all these factors varying in intensity, it is no wonder that the signs and symptoms of strangulation also vary to some slight extent. Stress has been laid on

¹ Stein, *Centralblatt für Chirurgie*, No. 19, 1894.

the most important ones ; the absence of any particular one, or rather the fact that it *cannot be elicited*, should not have too much weight attached to it.

The rule, laid down long ago, "when in doubt operate," has become more absolute and more widely followed. Nevertheless mistakes in the diagnosis and treatment of strangulation are still apt to occur, and some of the conditions giving rise to them may be illustrated.

1. The hernia may be very small and only general abdominal symptoms present, *e.g.* the case of a partial femoral enterocele (Richter's hernia, elsewhere discussed, see p. 203).

2. An irreducible hernia (largely if not entirely omental) may have caused constant trouble, and finally a loop of gut enters it and becomes nipped ; the increasing severity of the symptoms is not recognised until too late.

A woman has had an irreducible femoral hernia of considerable size for long—it has caused "dragging," abdominal pain, and occasional nausea and indigestion. The doctor regards it (rightly) as an omental hernia, and operation, if suggested, is deferred. One day a knuckle of small gut slips through the femoral ring, becomes tightly nipped, and as a result of the strangulation, the feeling of sickness changes to actual vomiting, the pain becoming much sharper, both in the hernial region and in the abdomen. The doctor finds little objective change in the hernia itself, and that in the symptoms is rather in degree than in kind. He decides to wait twenty-four hours, prescribes a purgative to be followed by an opiate later on—and by his next visit irretrievable damage has been done, and the patient's life is sacrificed to a mistaken diagnosis.

3. Many cases occur in which the surgeon sees for the first time a patient with a hernia and the symptoms of intestinal obstruction, and whether a trustworthy history can be obtained or not, it is only natural that the latter should be attributed to the hernia. Yet it may prove to have nothing to do with them.

A man of 30, with a right inguinal hernia, finds it irreducible of late, and, together with general malaise, has suffered from abdominal pain and discomfort for some days. A doctor employs taxis rather vigorously to the hernia, but does not succeed in reducing it, and the patient is sent up to the hospital. The right iliac fossa is board-like, and a confident diagnosis of peritonitis is made: the hernia is not very tense. There is no vomiting. The hernia is first operated on, only omentum is found in it, and that not strangulated. Abdominal section reveals peritonitis due to perforation of a loop of small gut lying in the right iliac fossa. But this perforation was not due to the taxis, nor had the loop apparently been in the hernia; *it was due to typhoid ulceration*.

The patient died on the operating-table.

Here is a case of extraordinary difficulty in diagnosis: indeed, having regard to the latency of the typhoid fever, we may consider it as impossible to detect. Of course hernia plus appendicitis would be a reasonable diagnosis to make.

In many cases an external hernia has coincided with intestinal obstruction, due to a band or other cause within the abdomen which was in no way connected with the hernia. For example, an elderly man was admitted to hospital with typical symptoms of acute intestinal obstruction: a right femoral hernia was found, but it presented no signs of strangulation. Immediate laparotomy was clearly indicated, but was for some reason delayed and the man died. At the autopsy a single loop of small intestine was found tightly nipped in a peritoneal aperture connected with the mesentery of the iliac colon. Note that the external hernia and the site of obstruction were on opposite sides of the body, and could have had no relation to each other.

One has known peritonitis due to perforated gastric ulcer coincide with irreducible hernia, and the latter to cause much doubt as to the diagnosis. If obstruction arise from cancer of the colon in a subject with external hernia it is obvious how easy it is for the doctor to make a mistake. Exploratory laparotomy in

all such cases should be done without delay, the incision being placed low enough to enable the hernia to be examined from within. Little time will then be lost in searching for the real cause of the obstruction.

Occasionally this will be found very near to the site of a hernia, whether the latter has been operated on previously or not. Thus M. Tesson records a successful laparotomy for acute obstruction in a young man who had been twice operated on for radical cure of a left inguinal hernia—this was two years before the onset of obstruction. A loop of strangulated small intestine was drawn from beneath the "inguino-colic ligament," a sharp fold of peritoneum connecting the left side of the meso-sigmoid with the region of the inguinal ring, and constricting the gut between it and the pelvic brim. This inguino-colic ligament or fold is to some extent a normal anatomical structure, but it may in this case have been rendered unduly prominent by traction exerted in the previous operations for radical cure, the second of which had been quite successful.

The inguino-colic fold otherwise is practically unknown as a factor in intestinal obstruction.¹

4. In young children or infants with strangulated hernia the right diagnosis is especially apt to be delayed. This arises partly from the extreme rarity of such an occurrence (see p. 214), partly from the fact that vomiting means so little, as a rule, in them, and the symptom of localised pain about the hernia cannot be elicited.

Stein² collected records of 110 cases of strangulated inguinal hernia in infants under one year old which were operated on by himself and other surgeons. He noted that the mortality following the operation (over 20 per cent) was too high, and we may ascribe this fact mainly to delay in making the correct diagnosis. In many of the cases retention of urine was observed amongst the symptoms of strangulation, a point to be remembered; it also occurs (but rarely) in adults.

¹ B. Tesson, *Bull. Soc. Anat.*, 1900, p. 261.

² Stein, *Centralblatt für Chirurgie*, No. 19, 1894.

Finally, it must be urged that *all* the signs and symptoms of strangulation in a case of hernia must not be expected in every case. We have seen that the condition, though usually of rapid onset, may be gradual, that remission may take place, that little or no reliance should be placed on "constipation" as a symptom, that vomiting may in rare cases be but little marked, or even absent. Absence of impulse in the hernia is often difficult to detect. The patient's history may be quite misleading.

The only safe course, if one or more symptoms and local signs point towards strangulation, is to operate with the least delay possible and not to wait until the case becomes "typical."

CHAPTER IX

STRANGULATED HERNIA: ITS TREATMENT AND RESULTS

ONCE the diagnosis of strangulation has been made the indication is clear—to arrange for operation with the shortest possible delay (in making the necessary preparations for asepsis and anæsthesia). It is useless to deny that in some cases (especially inguinal and umbilical) taxis under an anæsthetic may succeed in overcoming the constriction, but even then a later operation will be required for radical cure.¹

Why not then remove the immediate as well as the remote dangers at the same time?

If taxis be employed at all it should be tried only under the following conditions: First, the symptoms of strangulation have come on within a few hours; secondly, it should be of short duration, no force should be applied, the pressure should be made steadily with one hand raising and compressing the hernia whilst the other fixes the neck of the sac; thirdly, it should be done when the patient is under an anæsthetic and prepared for immediate operation if taxis fails.

¹ Years ago my father wrote in favour of more extensive use of taxis "in suitable cases" of strangulated hernia, and his arguments—supported by a series of statistics—were certainly weighty. But at that time radical cure had not come into its own. The opposite extreme is represented by surgeons who dissuade from the use of taxis altogether once the symptoms of strangulation have appeared, and there is much to be said for this teaching. The papers alluded to are in vol. v. of Sir Jonathan Hutchinson's *Archives of Surgery*, pp. 129, 137, 193, and 379.

For strangulated femoral hernia it should not be employed at all.

It is easy to lay down rules such as these, which obviously reduce the employment of taxis to a minimum, but it is notorious that in some cases before the patient is brought under surgical care taxis, often prolonged and forcible, has been employed. It is necessary therefore to deal, partly as a warning, with a serious accident which has resulted from the injudicious use of taxis.

False Reduction or "Reductio en Masse."—Under this term are included all cases in which by taxis (done by the patient or his surgeon) the intestine, still constricted by the neck of the sac, is pushed up into the abdomen. In former days when taxis was regularly employed before or instead of resorting to operation, a good deal was heard of this serious accident or complication.

Fortunately it has now become rare.

"Reductio en masse" (a queer hybrid of Latin and French) seems likely to be retained as the title under which several distinct conditions are grouped. From it one gets the picture of sac and contents being pushed up bodily, the relation of one to the other remaining still much the same. Such a picture, it will be seen, is not comprehensive enough—as other cases due to too vigorous taxis, attended with the same symptoms and requiring identical treatment, have not this pathology. They can, however, all be grouped well under the term False Reduction.

It is not absolutely necessary for strangulation to be present when false reduction is made, nor is the force required to produce it of necessity very great.

Although the fact is directly denied by some recent writers, it is certain that *the sac of a hernia may be itself mobile* and easily returned or drawn back without any pressure (I have seen this condition of wandering sac in inguinal hernia and in the lumbar region, see p. 171).

It was pointed out years ago (by Cruveilhier, Parise, Streubel, and Krönlein) that where there is a double sac

(properitoneal, intraparietal, or interstitial, or superficial to the external oblique) the intestine may be forced out of the scrotal sac into the other. Sir B. Moynihan has urged that cases of "reductio en masse" have been wrongly called so and they have depended on the pre-existence of a double sac. This view narrows the pathology too much, it underestimates the importance of taxis in producing false reduction, it ignores rupture of the neck of the sac, and it converts a small proportion of the cases into a majority, if not the whole.

The following are the chief varieties of false reduction, which as we should expect is far more frequent in the inguinal region—where taxis was and still is freely applied, than in the case of femoral hernia where the danger of taxis has long been known (inguinal, 80 per cent; femoral, 20 per cent).

1. A ring of peritoneum encircling a loop of gut is torn off the hernial neck and both are pushed up into the general abdominal cavity.

2. Part or the whole sac containing gut is forced into the subperitoneal tissue, or possibly between the layers of the abdominal wall.

3. A double sac existing—namely, a main one in the scrotum and a second interstitial one with a narrow aperture communicating with the neck of the former—the contents of the first are pressed into the second and there strangulated.

4. The neck of the sac is torn or has been divided by the surgeon's knife, the intestine is squeezed through the linear rent into the subperitoneal layer.

These four varieties include all or almost all the cases of false reduction. Common to all is this cardinal feature—that after the supposed reduction the patient's condition becomes worse, that if strangulation has been present its symptoms continue, there will probably be increased shock, worse vomiting, and more local pain. Nearly as characteristic is the fact that except in the first form (detachment of a ring of peritoneum) the

displacement of intestine leaves a fulness in the inguinal canal readily detected by the invaginating finger.

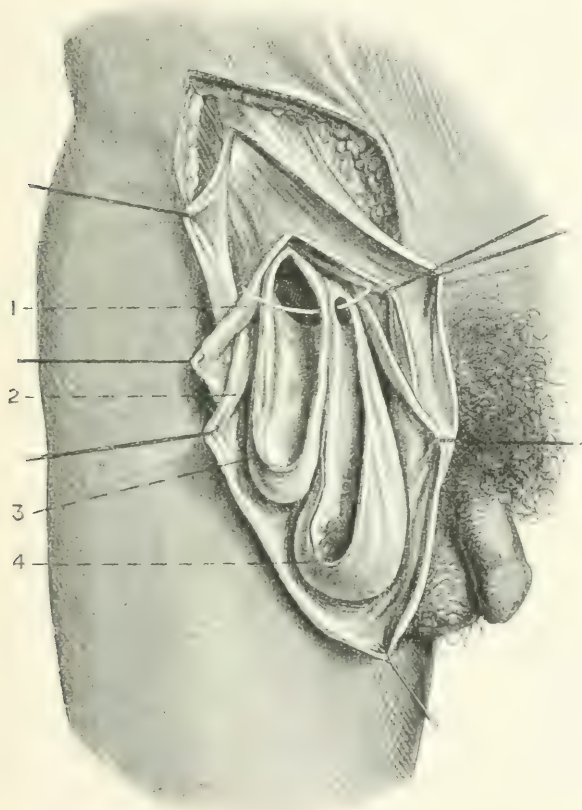


FIG. 49. Right inguinal hernia with double sac (3 and 4); a needle is passed through the small opening between the two, which is close to the internal abdominal aperture. The inguinal canal is opened up, the thickened cremasteric and infundibuliform fasciae are held aside (1 and 2). (Demeaux.)

Further, deep palpation of the iliac fossa probably reveals a tense and tender lump behind the abdominal wall (rarely in its substance).

What position do the sac and contents occupy when forcibly driven within the abdomen ?

Some years ago I had the remarkable experience of examining in the post-mortem room three cases of false

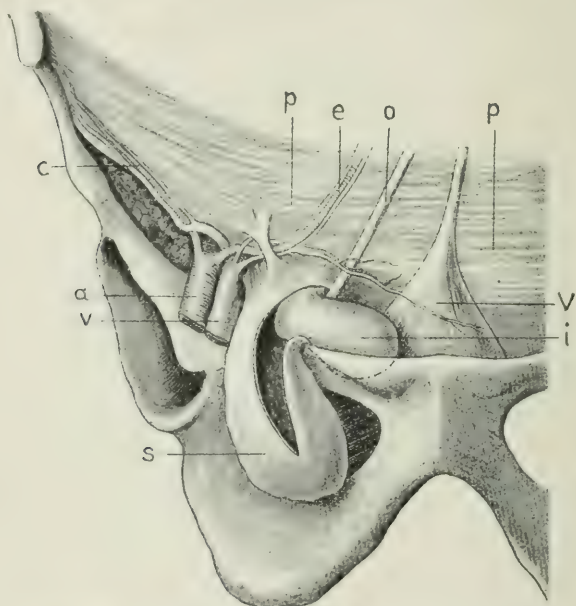


FIG. 50.—False reduction of a femoral hernia during operation. The sac (S) has been opened and is empty, but its neck still strangulates the loop of intestine (i) which has been pushed into the sub-peritoneal tissues between the pubis and the bladder (V); *pp*, the peritoneum; *o*, obliterated hypogastric artery. To the outer side of the sac are seen the femoral artery and vein (*a* and *v*) with the circumflex iliac and deep epigastric branches (*c* and *e*). (After Farabeuf.)

reduction.¹ In one the sac had been forced into the iliac fossa (between the iliacus and its peritoneal covering), in the second case it lay behind the transversalis mainly

¹ So far as my recollection goes in all these cases the accident had happened before the patients were admitted into the hospital. Around and within the displaced sac was considerable extravasation of blood in each case.

above the internal ring, in the third it had travelled downwards into the pelvis.

All these three directions of displacement could be illustrated by cases recorded by other surgical writers.

The diagnostic signs of false reduction or "reductio en masse" have been already described: it should be added that during the forcible taxis that led to the accident something unusual and wrong may have been noticed—instead of the gradual return of intestine with gurgling there has been a sudden jerky reduction (attended with much pain if the patient is not under an anæsthetic). Such an occurrence, together with the local signs especially the half-filled inguinal canal—demands an immediate operation which will probably save the patient's life and the doctor's reputation. Before referring to the form this operation should take, it is necessary to describe briefly the first variety of false reduction, which differs strongly from all the others and is of singular interest from the pathological standpoint.

The simplest form of "reductio en masse" is that where a ring of peritoneum constricting a loop of gut is bodily detached. I once performed abdominal section in such a case where taxis (done outside the hospital) had resulted in reduction of the hernia but with persistence of all the symptoms of strangulation. Well inside the abdomen a purple loop of small intestine was found to be tightly nipped by what looked like a complete ring of catgut—it was in reality the detached neck of an inguinal sac. The ring was divided with scissors and removed: fortunately the man made an excellent recovery.

Before this case occurred attention had been drawn to the subject in a similar instance¹ by my colleague Mr. J. McCarthy.

A man, aged 61, had undergone taxis, doubtless on many occasions, for a right inguinal hernia. When admitted he had signs of intestinal obstruction, though the hernia had

¹ Published in the *Path. Soc. Trans.*, vol. xxxii. p. 80.

disappeared. He declined operation and died of peritonitis. Within the abdomen was a gangrenous loop of intestine one foot in length, tightly constricted by a fibrous ring which was evidently the detached margin of the neck of the sac. The hernial sac consisted of two parts. That lodged in the scrotum was empty and normal, above this was a constriction corresponding to a very short inguinal canal, above this and projecting into the abdomen was another empty part of the sac resembling an egg-cup bowl in size and shape—its margin was rough and irregular.

These two cases were strikingly alike in their pathology and prove what extraordinary effects may be produced by forcible taxis on a hernia. Similar instances have been recorded by Langier, Richet, and Frank; probably many have escaped publication. I believe my own and one operated on by Hochenegg (reported in Frank's paper)¹ have been among the exceedingly few cases published in which operation (abdominal section and division of the constricting ring) was successful.

In dealing with this form of false reduction it is necessary to open the abdomen through a para-medial incision, as it would be impossible to detect and deal with the constricted loop from the region of the original hernia, the sac of which may be left for radical cure on a subsequent occasion.

But in all the other varieties it is probably best to start by opening up very freely the inguinal canal (in the rarer cases of false reduction of a femoral hernia this would also give good access—at any rate to start with). It has been found necessary sometimes to add a vertical incision through the abdominal wall before the exact damage could be ascertained and rectified.

Owing partly to extravasation of blood which may be present, partly to the deep displacement or position of the constriction, the operation may be exceedingly difficult, nor can any definite rules be laid down with advantage.

¹ Frank, *Wiener med. Woch.*, 1889, No. 5.

The chief point is to endeavour to draw down the sac to its original position, still more to ascertain the exact site of the constriction and to relieve it as early as possible.

It may happen that the damaged intestine requires to be resected (see p. 245), though this occurs but rarely, to judge from the cases published.

The rest of the operation includes complete removal of the hernial sac or pouches and as good a reconstruction of the divided muscles (with buried sutures of kangaroo tendon) as is practicable.

On the whole the outlook is not bad, provided the operation is undertaken within a very short time of the occurrence of the false reduction.

A word as to the fourth variety, where either in herniotomy for strangulation or in doing a simple radical cure—an incision has been made into the neck of the sac, and in subsequent pressure on the intestinal coils to reduce them they have been forced through this opening into the subperitoneal tissues. To judge from the silence of surgical authors on the subject one would imagine it was impossible for this to occur.

So far is this from the case that I am *certain it has happened to every surgeon with any wide experience of hernia operations*. Unless special care is taken to draw down and straighten the neck of the sac, if the patient strains while the open taxis is being done, nothing is easier than for a coil or coils to be squeezed into this false position. In America local anæsthesia is specially favoured for hernia operations, and one suspects this accident must be more frequent than when the patient's muscles are fully relaxed by a general anæsthetic.

Fortunately the surgeon will usually suspect there is something wrong with his reduction when this accident occurs: for example, he finds that all the coils will not go back, or there is (as in most cases of false reduction) a tell-tale lump or protrusion higher up. In such a case—perhaps with the aid of a prolonged incision—he is able to rectify matters, and to say nothing more about it.

I would again remark that this accident may easily occur, even in skilled hands, and that this warning against it cannot therefore be superfluous.

In considering the operative treatment of the ordinary cases of strangulated hernia it will be best to give the details fully as regards the inguinal form; many of them will be taken for granted in dealing with the others.

The Operation for Strangulated Inguinal Hernia.—It is well to ascertain before the anæsthetic the exact point at which the impulse on coughing ceases, for occasionally the site of strangulation is some distance below the canal (I have met with it in the scrotal portion of the hernia). But in the great majority the seat of strangulation is at the neck of the sac, about the internal ring.

The preparation of the skin to secure asepsis should be as thorough as time will allow; here the use of iodine in spirit after ether is especially valuable.¹ In most cases the stomach should be emptied of its foul contents, and lightly washed out with warm water through a soft rubber tube, immediately before the anæsthetic is given. As to the latter, see p. 45: spinal anæsthesia has some advantages, and also some obvious disadvantages, in cases of strangulation.

Some surgeons prefer local anæsthesia, and were the operation limited to a relief of the constriction much might be said in its favour. But as radical cure of the hernia should almost always be performed as part of it, this inefficient method of obtaining complete relaxation of the parts and freedom from pain during the deep dissection should, as a rule, be avoided.

The preparation of the patient includes ensuring that the bladder is empty: if necessary a catheter is passed.

The whole of the groin region has been shaved, washed

¹ I have found the following antiseptic solution invaluable for rapid cleansing of the skin:

Perchloride of Mercury	.	.	.	1 grain.
Carbolic Acid	.	.	.	25 minims.
Absolute Alcohol	.	.	.	1 ounce.

with soap and ether, then with biniodide of mercury in alcohol or the solution given in the footnote, p. 234, and finally painted with iodine in rectified spirit (2 per cent). As most cases of strangulated hernia suffer from shock every precaution is taken to relieve this, the whole body being encased in blankets, etc., except the limited area to be operated on, which is surrounded with sterilised towels. Hot-water bottles are useful, but they should never be placed in direct contact with the patient's skin for fear of burns.

As regards washing out the stomach, a long soft rubber tube attached to a glass funnel is the best to use, the water being at the temperature of 100°.

Steps of the Operation.—An incision is made over the inguinal canal, commencing about the centre of Poupart's ligament, but of course above it, and finishing over the external ring. Any vessels crossing this line in the fatty tissue are divided between two Wells' forceps. The aponeurosis of the external oblique is defined and divided over the whole length of the canal, the cremasteric layer is next recognised and the sac opened with special care, as the bowel is probably just beneath it. Blood-stained fluid will often be met with in the sac, which should be picked up with fine-pointed forceps, and divided sufficiently to allow the entrance of one finger. It is now easy to lay the sac freely open on the finger by means of scissors or blunt-pointed bistoury. The sac is cleansed with sterile swabs, and its contents, omentum or intestine or both, inspected. The next step is to divide the stricture, the position of which is ascertained by the surgeon's finger, acting as a director.¹ In incising the stricture the position of the deep epigastric vessels (to the medial side of the ring) should be borne in mind, and the cut made

¹ In dealing with femoral cases it is sometimes necessary to use a flat hernia director, but in inguinal ones the tip of one's little finger, if not the index, can always be insinuated (so to speak, "wormed") between the constricting ring and the sac contents. The herniotome is slipped in laying flat on the pulp of the finger and then turned towards the stricture, both finger and knife then being advanced.

in the upward and inward direction. In the very rare cases of strangulated direct hernia the epigastric vessels lie to the outer side of the ring, but the same direction of the incision, upwards and inwards, will still apply.

Instead of dividing the constriction at the neck of the sac from within, as was always practised until recent years, some surgeons prefer to incise it from the outer surface, that is working down on to the intestine. If great care be taken in doing this, it may answer just as well as the older method in most cases; but when the tension at the ring is great there must be considerable risk of the bowel being wounded, as it springs against the knife. It is a cardinal axiom in surgery that deep incisions should be made in the direction *away from* any important structure which there is risk of wounding, and this is surely a typical instance.

The loop of bowel should now be gently drawn down and the constricted part examined, since it is here that the injurious effects of the strangulation will be most manifest.

The next step is to reduce the gut, the fibrous and muscular structures around the hernial orifice being relaxed as far as possible. In both inguinal and femoral ruptures this is effected by flexing the thigh upon the pelvis. An attempt is then made to squeeze the bowel through the opening by a kind of kneading movement with the thumb and fingers.

The manipulation must be of the gentlest, and the surgeon must be prepared to exercise considerable patience. If the coil will not return by pressure applied at one extremity, it may yield by pressure applied at the other end of the loop.

In some cases of difficulty, the reduction is rendered easier if the margin of the hernial orifice is held up by means of a small blunt hook introduced into it, or by two pressure forceps grasping the opened sac and straightening its neck. This especially applies to large inguinal herniæ.

In other cases more bowel may be drawn down from the abdomen, and the reduction may then be directed in the line of "least resistance." The portion of bowel nearest to the ring can often be emptied upwards by judicious manipulation: this will make reduction easier.

Omentum in the sac is then dealt with, almost always it is best to excise it, taking care to secure all the vessels with fine catgut (each knot being a triple one, see p. 64, on dealing with omentum). The stump of the latter is inspected before cutting short the ligatures and returning it to the abdomen. The opening into the latter must be examined with eye and finger to make sure that it is clear from adhesions. On no account should an omental plug be left in this region.¹ It is a good plan to introduce a small moist swab grasped by a holder within the abdominal orifice: its withdrawal will satisfy the operator that there is no bleeding. A similar swab or sponge is held by the assistant at the opening, to prevent protrusion from coughing or straining, whilst the operator deals with the sac in the manner described on p. 57.

This may be rendered somewhat difficult by the opening into the sac being high up—but after the latter has been isolated (including its fundus) and raised as a whole, it is always possible by traction and torsion to pass the mounted needle through the pedicle and to tie the Staffordshire knot so as to shut off the general peritoneal cavity hermetically. Of course the swab or sponge is withdrawn when the sac is raised. The rest of the operation is exactly the same as for radical cure in non-strangulated cases. It is important to dissect out the lower part of the infected sac completely, and it is always practicable to narrow the canal, by suturing down the conjoined muscles in front of the cord to the outer pillar close to Poupart's ligament (see p. 58).

Should a drainage-tube be inserted? In the majority

¹ Omentum fixed to the region of Poupart's ligament is a fruitful source of intestinal obstruction later, and if left in a hernial orifice will favour recurrence.

of cases this is unnecessary, and where the sac has not been efficiently dealt with and a tube put in "for safety," a troublesome sinus is apt to result which may take months in healing.

After all hernia operations it is best to secure the dressings firmly by an elastic-webbing bandage outside the ordinary white linen, "butter-cloth" muslin, or gauze one. A single length is applied in figure-of-eight and secured by a safety-pin to the dressing below (see Fig. 14). The requisite amount of pressure is thus exactly obtained, the dressing cannot slip, and any strain in coughing or vomiting is taken off the wound. Before the patient is sent back from the operating theatre the stomach should *be again washed out with warm water until the contents come back perfectly clean*.¹ After that it is well to leave a small amount in the stomach, and if the patient's pulse is bad a warm saline per rectum—two pints with or without a moderate dose of brandy—given in divided amounts during the next few hours—will help to lessen the shock and improve the heart's action.

The Operation for Strangulated Femoral Hernia.—

An incision is made, three or four inches long, with its centre over the femoral ring. It may be either straight

¹ The object of washing out the stomach *before* the operation is to prevent regurgitation of foul fluid during its performance which may be so overwhelming and sudden as to flood the patient's air-passages, thus causing death by drowning. This is no remote danger. I once saw it happen whilst Professor Czerny of Heidelberg was operating on a woman with strangulated femoral hernia. (*N.B.*—Gastric lavage had not been done.) He immediately performed tracheotomy and endeavoured to clear the lungs by sucking out the fluid! It was heroic, as it might easily have caused Professor Czerny's death, but needless to say it was done in vain, the patient dying on the table. Many such cases have occurred of death from this cause. The precaution of washing out the stomach is such a simple one, it need hardly delay the operation at all, *but it is one readily forgotten and omitted*. Repeating the procedure at the end of the operation will justify itself to any one who tries it by the character of the stuff that will probably be withdrawn. It is astonishing the amount of fæculent fluid that collects in the stomach in some cases of strangulation, and its removal often just makes the difference between the patient recovering or dying.

or slightly curved with the convexity towards the middle line. The fundus of the sac is frequently covered thickly with fat, and there may be a lymphatic gland on its convexity. In some cases the sac is thin and easily recognised, but in others the operator may have difficulty in defining it from the surrounding fat. Blood-stained fluid is often present in the sac, or deep purple intestine may be seen through it. The sac should be seized with fine-pointed forceps and opened with due care at its lower extremity.

The opening in the sac is extended upwards towards the femoral ring, but not quite up to it: this latter precaution is to allow room for subsequent ligature of the neck. The two edges of the wound in the sac are seized with Wells' forceps and steadied by an assistant. The operator explores the interior with his finger. A common condition is for a small knuckle of intestine to be strangulated, whilst at the same time it is hidden by omentum. The latter should then be displaced outwards. The seat of strangulation is invariably at the femoral ring, and caused by Gimbernat's ligament and the deep curved arch of fascia. The operator seeks this point at the inner side of the neck of the sac, and insinuates the tip of his little or index finger between the intestine and Gimbernat's ligament. If the ring is too tight to allow of this a hernia director is used instead of the finger. The assistant meanwhile is holding out of the way any omentum that may be present. On the grooved director or the palmar aspect of the finger the herniotome is slid against Gimbernat's ligament. As this is done care should be taken lest the intestine overlap finger or director and be wounded.

The sharp edge of the ligament is only too easily felt: it should be nicked with the knife at two points, no deep cut being made for fear of an abnormal artery. The advance of finger and herniotome is simultaneous. If the director (which is, of course, neither so safe nor so accurate as the operator's finger) has been employed,

the latter should be inserted after the first cut has been made to stretch the ring. Before returning the intestine within the abdomen it should be examined as to its viability, especially that part which has been in direct contact with Gimbernat's ligament. With regard to the condition of the gut, so long as it is resilient or elastic, and there is no threatening of perforation, the surgeon should give it the benefit of the doubt, and return it "to join its fellows." The treatment of badly damaged or gangrenous intestine is discussed on p. 242. Omentum in the sac should be ligatured and cut off, the stump being returned. The empty sac is now ligatured and dealt with as described on p. 159. The radical cure is then completed by narrowing the femoral ring, etc.

NOTE.—Some operators advocate incising the constriction from without inwards; this must involve cutting through Poupart's ligament which weakens the part. Moreover it is Gimbernat's ligament that really causes the strangulation, and this is best divided from within the sac in the old way.

I would urge again the importance of not making a deep cut into Gimbernat's ligament, two slight incisions aided by stretching with the finger will relieve the tension sufficiently, and thus avoid risk of wounding a possible abnormal obturator artery (see p. 153).

The Operation for Strangulated Umbilical Hernia.—

A few special points need only be referred to, as the ground is largely covered in the section on radical cure.

1. The hernia is probably large and lobulated, its interior divided into compartments and with much adherent omentum. The gut involved will be large or small intestine, probably both.

To open first the fundus of the sac (as is done in strangulated inguinal or femoral hernia) will probably lead to waste of time in getting at the site of constriction, which is at the aponeurotic aperture. Hence it is best to make an elliptical incision, with its long axis either vertical or transverse, to work rapidly through the fat

to the surface of the external oblique, and so all round the sac neck. The hernia being drawn over to one side its neck is opened cautiously with the scalpel, and then a finger introduced within the sac enables a circular incision to be made with scissors around the neck. The constriction is incised at either the upper or lower pole of the orifice by a blunt-pointed bistoury or herniotome, the finger guarding the intestine. The latter is examined: if adhesions exist they are divided, any fluid or blood in the sac removed with moist swabs, the orifice held up with a blunt hook and the intestine returned.

Even if the condition of the strangulated bowel be very unpromising, no other course seems open than to return it in the hope it may recover. Resection of intestine in these cases is almost invariably fatal, drainage by Paul's tube equally so.

Omentum is carefully tied at its pedicle and the whole of the sac already liberated, with the thinned and redundant skin over it, removed in a mass: this avoids having to separate omental adhesions to the fundus. A sponge on a holder is used to plug the orifice temporarily whilst radical cure is completed as rapidly as possible, preferably by Method 1 (p. 125).

The dressing is held in place and the abdomen supported by a special binder of strong material secured by safety-pins—this should have been prepared by the nurse in readiness. In the case of a very stout woman the ordinary broad flannel bandage will be useless, and the many-tailed bandage is little better.

In the after-treatment it is important to nurse the patient well propped up in bed, and to assist her respiratory and cardiac functions in every way. Turpentine or other enemata are indicated.

Hypostatic pneumonia and sudden cardiac failure are prominent causes of death after the operation, as might be expected from the type of patient in whom it is usually required. Digitalis, stimulating expectorants, and brandy may be found useful in warding off these

dangers. The elevated position of the thorax has been already insisted on.

It has been assumed in the foregoing description that after release of the constriction, and careful examination of the contents of the sac, it has been thought right to return the intestine as being viable and likely to do well. This will include the very great majority of cases. Whatever the apparent condition of the omentum in the sac it should be excised, after its pedicle has been slightly drawn down so as to insert the ligatures through a healthy portion of the membrane. This is done with an aneurism needle threaded with fine silk or catgut; each ligature is made to hold only a small segment and is tied very securely with a triple knot. The pedicle is inspected before allowing it to slip back into the abdomen.

But in a certain proportion of the cases the surgeon realises that the nipped bowel is in such a state that to return it would be fatal from the fact that (1) perforation is on the verge of occurring at one definite spot, perhaps the gut wall is only holding by its peritoneal coat; or (2) more extensive gangrene of the loop is certain to ensue, or has already commenced.

In the first case he will probably decide to turn in the damaged spot by Lembert's sutures, just as an ulcer of stomach or duodenum is dealt with. Many successes have been recorded after this limited procedure in strangulated hernia: but even supposing the sutures hold well, adhesions are almost certain to occur between the repaired loop of intestine and other loops within the abdomen. In one case I knew of recently, a strangulated piece of gut had been patched up in this manner and returned: intestinal obstruction gradually came on in the next fortnight, and a lump could be felt through the abdominal wall which was very tender. Laparotomy was performed, the lump was found to be intestine matted all round the repaired loop, and in the centre of the lump was a small abscess immediately over the repaired portion and containing the sutures. Resection of a good

deal of the inflamed gut, with end-to-end junction, was fortunately successful.

It must also be remembered that extensive suturing of a damaged loop in the manner described, apart from leading to adhesions, inevitably causes a kink, and so may produce obstruction or volvulus subsequently.

If it is obvious that a considerable area of bowel is dead or moribund there are two courses open. If the patient's condition at that moment is too bad to warrant a fairly long operation, as primary resection must be, the loop may be drained with a Paul's glass tube attached to a thin rubber continuation of it. Two or three sutures are used to anchor the loop in place to the skin. These sutures of course must only take up the outer and middle coats of intestine. In this way it is hoped that after the tube has come away, and the fistula lasted a week or two, a secondary laparotomy and resection of gut may be performed. Should the patient survive long enough for this to be attempted, the procedure will prove to be a very difficult and dangerous one. But unfortunately these cases nearly always end fatally before the second stage is reached.¹

The course that offers the best hope in dealing with gangrenous gut in a hernia is *primary resection with either end-to-end or side-to-side union*. It is essential that comparatively healthy portions of gut should be joined together, and this may imply excision of many inches, perhaps a foot or more. Obviously the limited space provided by the herniotomy wound does not allow of proper inspection and resection of the necessary amount. This applies especially to femoral hernia, in which most of the cases of gangrene are met with.

¹ Cases have been mentioned on p. 210 where complete recovery followed spontaneous gangrene and formation of an artificial anus—without the aid of the surgeon. So now and then recovery has ensued after the operator has drained the loop of gut *in situ*—but the cases are remarkably few. This method of treatment is “to be regarded as a last resource of desperation” (R. Warren, *Textbook of Surgery*, ii. 314). See p. 251.

Therefore I would urge that a separate median laparotomy should be performed (the patient's pelvis is raised if necessary), the loop is drawn up through the hernial ring (of course the constriction has been divided before this) and so out of the abdomen. It is protected from soiling the peritoneum by being held in a warm moist pad of gauze, and outside the upper wound is isolated and packed round by these pads.

Much importance is attached to the making a second incision and transferring the loop of intestine which is to be excised from the confined hernia area to the freedom and absence of constraint found in a median abdominal wound. As a rule resection is attempted through the herniotomy incision, and this partly accounts for the high mortality attending it and the disfavour with which some regard the procedure.

How can the condition of the mesentery and proximal part of the gut be satisfactorily ascertained, the clamps kept out of the way, and suturing effected in the limited space given by a femoral herniotomy wound? Moreover, supposing the resection completed, the suture-line will be endangered as the gut is *pushed* back into the abdomen, whereas in the method advocated (through a median wound) after the union the loop is simply *dropped* back into place.

There is yet another argument—it is all-important to make the upper section of gut through a healthy part, and it is only possible to secure this by examination of the intestine for many inches above the gangrenous area. Failure after resection has without doubt often been due to removing too short a segment.

The following method of excision of the gangrenous part is advocated by some. “Pull the loop down, crush and ligature through healthy gut on either side of the gangrenous part, and tie off the mesentery; excise the gangrenous part and oversew the ligated ends with purse-string suture. Clean out the sac and wash the latter with an antiseptic lotion. Next open the abdomen by para-

medial laparotomy above the pubis and pull the two blind ends of intestine through the femoral ring and unite by lateral anastomosis. The wounds are then closed in the usual manner. In this way there is less risk of fouling the peritoneum than if the gangrenous loop be pulled back into the abdomen before excision is performed, while the femoral canal need not be enlarged.”¹ Of course the same procedure might apply to an inguinal hernia. I doubt if there is much risk of soiling the peritoneum in transferring the loop from the lower wound to the upper—a very short distance—and it can be easily guarded against. Moreover it seems best not to start the excision in the confined area of the lower wound, as afterwards it may be found necessary to remove still more of the proximal end.

We will suppose the operator has brought the damaged intestine up first through the enlarged hernial ring, then through the paramedial laparotomy wound, and that it is resting on warm moist gauze swabs. A careful inspection is made to decide how much gut must be removed. Having decided this the surgeon applies two straight intestinal clamps (Sir G. Makins’s pattern is excellent) just tight enough to close the lumen and no tighter. They must be applied well on either side of the intended excision-line and at right angles, or nearly so, to the axis of the gut.

1. With due precaution to avoid soiling the wound the involved part is rapidly cut away with straight scissors, as little mesentery being removed with it as is indicated. Be free in removing intestine, very sparing with its mesentery.

The small veins and arteries are caught at once and tied. If the gut above is full of semi-fluid contents and gas it had better be evacuated. This is done by drawing out a few coils of the proximal and distended intestine, relaxing the clamp and very gently squeezing the contents into a receiver. The clamp is then re-applied, the part

¹ Richard Warren, *Text-book of Surgery*, ii. 315.

beyond carefully cleansed and the union of the two divided ends proceeded with.

If a glass tube be tied into the proximal end and a more thorough evacuation of the upper coils be attempted through this it will be necessary to make a fresh section of intestine above where the tube was secured. It will be found impossible really to empty the intestine, and the attempt to effect this may do more harm than good.

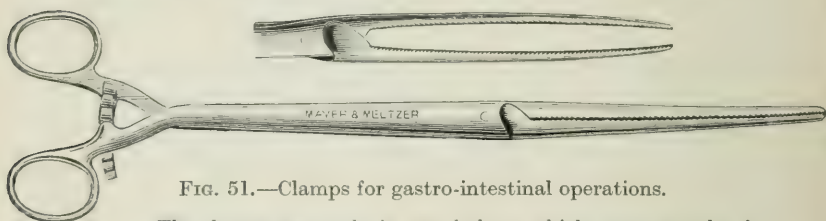


FIG. 51.—Clamps for gastro-intestinal operations.

The clamps are made in two halves, which come asunder for aseptic purposes. The degree of pressure on the intestine can be exactly regulated by the catch close to the handle. The lower figure shows the clamp completely closed.



FIG. 52.—Makins's intestinal clamp.

Vigorous handling will increase the risk of subsequent paralysis of the gut.¹

We must be content with temporary relief to the coils immediately above the resection area, and even this is difficult to secure without soiling the wound. If the

¹ There is another method of letting out gas and fluid contents from the proximal side of the resection area—namely by a cannula inserted a considerable distance above the latter. The clamps are kept on all the time—and the small wounds made by trocar and cannula should be carefully sewn up and invaginated after the cannula has been withdrawn. Unfortunately my experience of this method of emptying intestine has been that it is a poor one; the stuff will not come through the cannula readily, the instrument slips, and soiling of peritoneum is almost certain to occur. This method of relieving distension is, however, recommended by some writers (*e.g.* Mr. W. G. Spencer).

bowel is not much distended it is better to go straight on without trying to drain the upper end.

2. The two divided ends of intestine are now placed close together and the suturing commenced. The first row includes all the coats and is continuous, generally catgut (lightly chromicised) is employed for this: I have always used fine silk. The start should always be made at the mesenteric border, here a separate mattress stitch should be applied and knotted (of course on the internal aspect of the gut). Then a curved needle armed with a long thread is passed through all the coats—again at the mesenteric edge.

Half the thread is drawn through and tied in a double knot towards the lumen of the gut. This leaves a long end which is temporarily held in a pair of Wells' forceps. With the other end, to which the needle is attached, the surgeon carries his continuous suture through all the coats from the mucous membrane outwards, towards the free border of the gut, *i.e.* that opposite to the mesentery. The suture passes from mucous membrane to peritoneum on one side, then from peritoneum to mucous membrane on the other. A single knot tied in the thread at every third insertion will prevent constriction of the lumen. The sutures should be placed as closely together as possible. As the free border is reached the suture is left rather loose, another needle is then threaded on the other end which, again starting from the mesenteric edge, completes the union of half the circumference of the gut. The two ends are now drawn sufficiently tight and tied together. The knot must, of course, be made on the outer or peritoneal aspect, but this is of no moment. The ends of the thread are cut short close to the knot, and with a fresh needle and thread the second row of sutures (Lembert's) is commenced. This should again be started at the mesenteric edge. Whether interrupted sutures or a continuous one are employed may be left to the surgeon's discretion, but the continuous one is undoubtedly the quicker method for both rows, and is essential for the inner one.

The chief difficulty will be found in the first row in bringing the whole circumference of either end of the gut into even and accurate apposition. It is a good plan, after starting the continuous thread at the mesenteric border, to insert one or two guide sutures (through all the coats) with an entirely different needle and thread, at one-third of the distance round the intestine.

3. The clamps are now removed and a careful examination made of the suture-line round the whole circumference of the gut. If there is any indication of a weak spot it should be strengthened by an extra Lembert's suture or two.

If the suturing has been well done no fear need be entertained that the lumen will be so narrowed as to form a stricture later on.¹

The mesentery is now dealt with; if its vessels have not already been secured ligatures are applied, and the mesenteric aperture thoroughly closed by a continuous suture.

The parts are washed with warm sterile water and dropped back into the abdomen. It will save time if, whilst the operator is closing the laparotomy wound, his assistant deals with the lower one. It may be advisable to drain the latter, but so far as is practicable a radical cure should complete the operation.

It is hardly necessary to say that from the beginning every means should be taken to combat shock, and that all reasonable speed should be employed. If a general anæsthetic be given the amount should be kept at the minimum.

Such is the main outline of an operation which is one of the most searching tests of an operator's skill in the whole range of his work. If it succeeds the patient has been rescued from a certain and painful death for an

¹ In one case where I had removed twelve inches of gut the opportunity occurred several years later of examining the part where resection had been done. There was not the least diminution in calibre, all traces of the sutures had disappeared, though fine silk had been employed for both rows.

indefinite period, but failure is only too easy and probable. A slight fault or weak spot in the suture-line may lead to leakage in a few hours, or even a fortnight after the operation. Another cause of failure is that the intestine may not regain peristaltic power, a third that poisoning from the foul intestinal contents may have gone too far for the patient to rally.

What percentage recover? Any individual surgeon's experience of intestinal resection for gangrene of gut cannot be very large. Personally I have done fifteen of these operations: seven of the patients recovered, eight died. This percentage about 50 agrees exactly with the figures, running into several hundreds of cases, compiled at various times by different authors—but it must be remembered that these are chiefly drawn from published records in which success is more apt to be given than failure.

In civil practice during the last few years undoubtedly *lateral anastomosis* (after resection of the damaged parts and closure of both ends) has come into favour. In cases of obstruction, *e.g.* from strangulated hernia, it has one great advantage—that the difference in calibre between the two portions to be united does not matter. On the other hand, it generally takes longer to perform, there being three separate sets of suturing to do instead of only one: again we should expect normal peristalsis and flow of contents to be established with more difficulty: finally there is a chance of leakage or inflammation around three sutured wounds of intestine. Reason would therefore lead us to prefer end-to-end union but for the difference in size between the afferent and efferent parts of gut, and personally I have not found this cause much difficulty. The answer to the question which method is the best can only come from statistical results—and that these are not infallible is well known.

During the recent war extensive opportunities occurred for performing resection of intestine, and opinions varied as to whether end-to-end or side-to-side union gave the

best results. I think it would be roughly correct to say that at first direct union of the two ends was most in favour, but that after lateral anastomosis had to some extent supplanted it, the end-to-end operation was again most often resorted to. Of course the conditions were far from identical with these governing resection of gangrenous gut in hernia cases, especially with regard to the age and vitality of the patients, and the state of the intestine near to the resection.

It is unnecessary to describe the operation of lateral anastomosis as the other operation has been given fully, and the principles of suturing are exactly the same—two rows, the first traversing all the coats, the second the outer two only.

The following complete record of all cases of gangrenous gut in hernia operated on at the London Hospital during five recent years (1917 to 1921 inclusive) will show that both methods were almost equally popular, and the result, though slightly in favour of end-to-end suture, is hardly conclusive:

Cases of gangrenous gut operated on, 42:

Treated by partial excision and suture, 1 recovered.

Treated by open drainage with resection, 5, of which 1 only recovered.

Treated by excision and end-to-end suture, 18, of which 8 recovered.

Treated by excision and side-to-side anastomosis, 13, of which 5 recovered.

Treated by excision, method of union not stated, 5, of which 2 recovered.

It will be seen that excision and sutural anastomosis gave 15 recoveries out of 36 cases, which agrees very closely with my personal record of 7 recoveries out of 15 (all end-to-end). We may infer that the operator will be wise to choose which of the two methods he feels himself to be more proficient in.

Of the 42 cases 22 were femoral, 11 inguinal, 4 ventral, 4 umbilical, and 1 sciatic.

All the umbilical cases proved fatal, indeed there are few conditions more utterly hopeless than that of gangrenous intestine in an umbilical hernia! The high mortality after resection in the above list, which represents the most recent operative work by a number of surgeons of special skill and experience, may be thought somewhat disappointing. But the condition of toxæmia of the patient is nearly always to blame rather than the operation itself: moreover it should be noted that 14 out of the 42 patients were sixty years old or over, of whom 6 were at least seventy years. Nevertheless of these 14 four recovered.

Drainage of Intestine above the Site of Strangulation.

—Unless resection of part of the gut is performed this does not arise, and even when it is completely divided the difficulty of emptying more than a few coils through the proximal end has already been pointed out. Impressed by this fact Mr. Hamilton Whiteford urged some years ago that "the evacuation of the intestine" (above the strangulated area) "can only be done by draining the distended bowel through a large tube for several days." He advocated opening the strangulated loop, tying in a Paul's tube, anchoring the loop by a few stitches *in situ*, and waiting to do resection at a later date. He brought forward no successful cases, and my belief is that they would be difficult to find. Most surgeons have occasionally resorted to such drainage in isolated cases, and have seen the patients die within a few days, before the second operation could be attempted. The figures adduced from the London Hospital are conclusive: in only five instances was drainage carried out and only one resulted in recovery. To adopt Mr. Whiteford's plan as a routine would be disastrous.

The Treatment after Operation for Strangulated Hernia.—This does not differ materially whether resection has had to be done or not, though of course the longer the operation the greater the danger of death from shock and exhaustion. The ordinary herniotomy

for strangulation, including radical cure, rarely occupies very long and the amount of shock induced by it is negligible. Hence there is no point in the argument of some American writers that a local anæsthetic should always be used instead of general anæsthesia during operations on strangulated hernia.

As a matter of fact the repeated injections required for local anæsthesia and the necessary delay between them cause more time to be taken up in the operation than otherwise. Moreover, should the operation present unusual difficulty, or should resection of gut be found necessary, the local anæsthesia will not suffice. Granted then that the patient has been kept warm throughout the operation there is little fear of shock, but it is a useful precaution to administer per rectum an injection of warm saline (one to two pints given gradually before the patient comes round) to which $\frac{1}{2}$ oz. of brandy may be added.

As impressed elsewhere, it is essential that the stomach should have been thoroughly cleared by washing out before the patient is sent back from the theatre. This will probably remove the risk of foul stuff being vomited before consciousness is restored—but in any case this risk must be prepared for by the nurse, who must not leave the patient for a moment until the latter has “come round,” and who must have everything ready for clearing the pharynx, etc., in case of vomiting.

It is unlikely that anything will be tolerated if taken by the mouth, until twenty-four hours or so have elapsed, except water.

A moderate dose of morphia should be given hypodermically if required, but of course this tends to increase the chief difficulty after herniotomy—namely, the starting of good downward peristaltic waves and a free action of the bowels.

Sir James Paget¹ taught that it was always best to

¹ Sir James Paget, *Clinical Lectures*—a work dealing with hernia and other subjects; well worth reading though written many years ago.

leave this to Nature to effect, but since Paget's time opinion has somewhat changed on this point. If no action occurs within twenty-four hours or so, some surgeons give an aperient by the mouth, but this is very apt to bring on vomiting. Apart from this we have two valuable drugs which may be given hypodermically at any time after the operation—namely, eserine and pituitrin. Both act as stimulants to the muscle-wall of the intestine. Pituitary gland extract is perhaps the most effective, and is injected into a muscle in the dose of .5 to 1 c.c. of 20 per cent extract. Salicylate of eserine is given subcutaneously in doses of $\frac{1}{100}$ grain, repeated every four hours until six doses have been given.

A turpentine enema also will often serve to start peristalsis of the bowel: it is an invaluable aid to abdominal surgery, is a remarkably safe measure, and may be repeated more than once if necessary. A good way of administering it is the following: give turpentine oil 1 to 4 drachms, in soft soap $\frac{1}{2}$ oz. and warm water 10 oz. Follow this up shortly with a second 10 oz. of the soap and water. Castor-oil is the best aperient, to be given about the third day after operation. If only peristalsis has been re-started and the bowels have acted, probably all will go well.

As regards the herniotomy wound a word of caution is necessary. It not infrequently happens that, a few days after the operation, the temperature gradually rises and the patient looks flushed. The wound is inspected, but nothing abnormal is seen as regards the superficial stitches, though probably there is local tenderness or discomfort. These are almost infallible signs of deep suppuration, due to the tissues having been infected before or at the time of the operation. In such a case two or three sutures should be removed and a director or dressing-forceps inserted to the depth of the wound, a few days' insertion of a drainage-tube being indicated. This complication, deep suppuration, is especially apt to occur in the case of femoral herniotomy: it usually

reflects no discredit on the operator's technique, and if *only dealt with promptly* should cause but little trouble. In a few cases boracic fomentations as well as the drainage-tube may be required.

The rule should be—in every case where the temperature steadily rises soon after the hernia operation, make sure that deep suppuration is not the cause.

The onset of pneumonia, perhaps very limited, and in any case not easily detected at first by physical signs, may also send up the temperature. Pneumonia and “bronchitis” are fairly frequent complications after herniotomy, and it must be remembered that many of the patients are “bronchitic” at the time their hernia becomes strangulated. These complications are serious, they tend to prevent normal healing in the wound, and may in themselves be a cause of death. However, in many cases the inflammation of the lungs remains “patchy,” and slowly—very slowly—clears off. The degree of fever accompanying it is rarely like that of an acute pneumonia.

Stimulants in the form of brandy and egg mixture, brandy alone, stimulating expectorants, strophanthus, or digitalis, plenty of good liquid food—these form the chief measures to be adopted. The patient should have a Gamgee-wool vest over chest and abdomen, and should be kept as warm as possible.

The anæsthetic was often blamed for this complication of pneumonia after operation, but there is little or no doubt that infection through the blood stream by the bacillus coli is the true cause.

As complications after the operation we have noticed suppuration in the herniotomy wound, pneumonia, and failure of the bowel to re-establish peristaltic flow. If the last named persist and become serious it is known as paralytic ileus. It is characterised by complete failure to keep anything down, by constipation and by increasing distension of the abdomen. The same symptoms with rigidity of the wall indicate peritonitis, starting from the damaged coils, and possibly due to perforation. If the

patient is steadily getting worse in spite of the measures described above, the question will naturally arise of an exploratory abdominal section. The outlook of such an operation is deplorably grave. Should the paralytic ileus be found to be due to inflammation and matting of the intestine, an enterotomy with drainage might seem to be indicated, but the patient is most unlikely to recover. If the gut has leaked through a perforation or by more extensive gangrene, excision is but a forlorn hope. Occasionally a condition of enteritis supervenes, due to the bacillus coli, and shown by the passage of very offensive fluid motions or of mucus and blood, with sickness and abdominal pain. This is to be met by confining the food to Pasteurised milk given warm, and by appropriate doses of bismuth and morphia.

Finally we have to note the occurrence, perhaps a long time after recovery from the original operation, of chronic intestinal obstruction due to kinking of intestine, bands, or stricture. The omental pedicle—especially if too much has been tied in one knot or if stout silk has been used, has also been the cause of trouble. One writer collected no less than 40 cases of this kind, all following the use of thick silk. Such a complication ought never to occur, and will not if due care be taken to tie the omentum in small segments, and with catgut or fine Japanese silk.

Should the symptoms and signs of intestinal obstruction arise in a patient who has previously undergone an operation for hernia (we are not referring to immediate sequelæ) no time should be lost before resorting to exploratory laparotomy. The cause of obstruction will probably be found near the site of the first operation. Its exact nature, judging from one's own experience and the cases recorded by others, will be impossible to forecast, and may be any one of a great variety. But whether a band has to be divided, a twist unravelled, a lateral anastomosis performed, or a complete excision of a coil carried out, the prognosis is comparatively favourable.

provided undue delay has not led to extreme abdominal distension. The presence or absence of this last condition is the turning-point between failure and success of the operation.

Grave as still is the surgeon's outlook in acute intestinal obstruction (apart from intussusception), I believe no class of case is so hopeful as that where the history of a remote herniotomy provides the clue. Such at least has been my experience, and it contrasts strongly with that of secondary operations done within a few days of the one performed for strangulation. These latter are so hopeless as a rule that reliance on non-operative measures alone may be justified in most.

Fortunately both classes—those in which severe obstruction comes on soon after a piece of strangulated gut has been returned to the abdomen, and those where it occurs long afterwards—are uncommon, and any individual surgeon's experience of them must be limited.

The General Mortality after Operation for Strangulated Hernia.—The results of the special measure—resection of gangrenous intestine—have been discussed on page 249.

Perforation or gangrene of the gut accounts for a considerable proportion of the total deaths. It is of interest to consider the mortality from all causes, including post-operative pneumonia, peritonitis, toxæmia, etc.

The following personal record of 168 consecutive cases of strangulated hernia includes even those where the operation was done as a forlorn hope, and of course those in which resection had to be done.

	No. of Cases.	Deaths.	Percentage.
Strangulated inguinal	74	12	16
" femoral	69	18	27
" umbilical and ventral	25	7	28
Total	168	37	22

Few operations test the surgeon's skill and power of decision more than those for the relief of strangulated hernia, and it would be strange if increasing knowledge of the difficulties and practice in meeting them were not reflected in the results. Of my first 74 cases I lost 23, of the next 71 only 7. Possibly the results in umbilical hernia were fortuitously good, as many other statistics could be quoted giving the death-rate in this variety as between 45 and 75 per cent.

Some years ago the records of all the large London Hospitals were searched and tabled with regard to the mortality following herniotomy. The results were fairly uniform, and showed the highest percentage in umbilical hernia, the lowest in inguinal. The average for all varieties (over 1000 cases) lay between 40 per cent and 50 per cent.¹ It will be seen that this is about twice as high as my own record.

But the mortality would be reduced to a minimum if only the medical profession and the laity would recognise the binding necessity for resort to surgery on the very first appearance or threatening of strangulation in a hernia. The risk of the operation is in itself but little, it is almost always the delay beforehand that leads to the needless sacrifice of a life. And it must be admitted that this delay is quite as often due to the physician as to the patient or the friends.

It is still not unknown for cases of strangulated hernia to be brought to the Hospital moribund at the end of three or four days of "medical treatment"! Nor is it possible ever to bring home to the right shoulders the responsibility for this deplorable delay.

Of course now and then it is the obstinate refusal of patients or relatives that is to blame, but more often it seems to be the failure of the doctor to insist that the only hope lies in immediate operation, that every hour adds to

¹ These statistics were obtained by Sir Frederick Treves, Sir Anthony Bowlby, Mr. James Berry, and the present writer.

the risk, and that medical treatment has no place whatever in dealing with strangulated hernia.

Apart from the gradual education of the profession in this matter, there is ground for satisfaction from another point of view.

Every successful radical cure of hernia thereby removes the risk of strangulation in that individual in the future. The readiness with which most men with hernia seek cure by operation (and in less degree women), its widespread practice by surgeons, and the great improvement in methods of performing radical cure during the last twenty years have without doubt diminished the proportion in which strangulation has a chance to develop.

It is no mere impression that (as tested by the work at the large urban hospitals) the operation for strangulated hernia is less frequently called for now than twenty years ago, especially taking the increase of population into account.

Doubtless the time will come when it will be as rare an event as that for vesical calculus, which to our forefathers was one of the most important of all major operations, and is now rarely seen in this country.

What is wanted is a widespread recognition that radical cure of hernia has now become one of the safest and most satisfactory of all operations. I would urge once again, that this is the case only if the operator regards it as worthy of as much study to perfect his methods, and willingness to devote all due energy and time to its performance, as any less common and more "interesting" surgical procedure.

INDEX OF AUTHORS

- Alessandri, 201
 Annandale, 19
 Auerbach, 167

 Balfour, 172
 Ball, Sir C., 63, 64
 Barker, A. E., Prof. (Sir), 42, 61,
 127, 141, 150
 Bassini, 28, 67, 81
 Battle, W. H., 182
 Berger, Prof. Paul, 3, 34, 91, 104,
 114, 143, 156, 164, 168, 210
 Berry, James, 257
 Bier, Prof., 42
 Bloodgood, 50
 Bönnecken, 217
 Bonomo, 128
 Bowlby, Sir A., 165, 257
 Brodie, Sir B., 22
 Brünner, 166, 197
 Bull, 49
 Burghard and Cheyne, 99, 128,
 141, 151
 Butlin, Sir H. T., 20

 Carlé and Nicoladoni, 82
 Ceccopieri and Scarrone, 82
 Cheatile, Sir L., 75-78, 150
 Chevereau, 174
 Cheyne, Sir Watson, 162
 Choyce and Beattie, 142
 Clado, 192, 217
 Cleland, Prof., 91
 Cloquet, J., 153
 Coley, W. B., 5, 48, 49, 106
 Cooper, Sir Astley, 2, 18, 25
 Cooper, Dr. Austin, 44
 Cruveilhier, 227
 Curling, W. B., 14, 15, 18, 22, 89,
 90, 91
 Curtis and Gibson, 67
 Czerny, Prof., 238

 Deipser, 110
 Delagenière, 197
 Deroubaix, 149
 Dubosc, 130
 Dujarier and Castaigne, 191
 Durham, A. E., 190

 Ebner, 197
 Eccles, McAdam, 79, 87, 102, 152,
 161
 Eggenberger, 197

 Féré, Ch., 215
 Firth, Dr. C., 164, 170
 Fitzwilliams, D. C. L., 189
 Frank, 232

 Garmo, de, Dr. W. B., 1, 34
 Garré, 217
 Gask and Spencer, Messrs., 50, 54,
 134
 Godard, 91
 Gordon, 162
 Gosselin, 207
 Gross, 199
 Guinard, 178
 Guterbock, 197
 Guttmann, 184

 Halsted, 27, 28, 29
 Hartmann, 198
 Hektoen, 190
 Hoehenegg, 232
 Holmes, Sir T., 214
 Howship, 168
 Hulke, J. W., 22
 Hutchinson, Sir Jonathan, 44

 Jacobson, 198
 Johnson, Raymond, 12

 Keenan, C. B., 172

- Keetley, C., 99
 Kennedy, A. E., 120
 Kingdon, 3
 Kocher, Prof., 63, 159, 213
 Krönlein, 114, 197, 227

 Langier, 232
 Lawrence, Sir W., 23, 154
 Le Dran, 15
 Lenander, 197
 Lister, Lord, 211
 Liston, 101
 Littre, 208
 Lockhart-Mummery, 87
 Lockwood, C. B., 50, 56, 135, 192, 194
 Lotheisen, 162
 Lucas-Championnière, 37, 83, 128

 Macalister, Prof., 28
 McCarthy, J., 231
 Macewen, Sir W., 61, 211
 McGavin, L., 132
 Macready, 170
 Makins, Sir G., 171
 Malgaigne, 3
 Mansell-Moullin, C., 155
 Marshall, 91
 Mayo Clinic, 83, 87, 105, 124, 129, 133
 Méry, 197
 Mignon, 98
 Monod, 197
 Monro, 197
 Morgan, de, C., 22
 Morris, Sir Henry, 144
 Moynihan, Sir B., 114, 228
 Murray, R. W., 85, 132

 Nageotte, M. Jean, 50
 Nepveu, 217

 Osler, Sir Wm., 193
 Owen, Edmund, 171, 200

 Paget, Sir J., 19, 152
 Parise, 227
 Parry, 162
 Partridge, 154
 Pelletan, 18
 Pendlebury, 71
 Petit, J. L., 197
 Piccoli, 128
 Picqué and Poirier, 164
 Pollard, Bilton, 191

 Pott, Percival, 199
 Pringle, 29
 Puech, 176

 Quain's *Anatomy*, 91, 101
 Quain, Richard, 105, 153

 Richet, Prof., 232
 Richter, 208
 Rizzoli, 14
 Robin, 91
 Romberg, 168
 Roser, 213
 Roubaix, de, 213
 Russell, 5

 Scarpa, 17, 206
 Scudder, 172
 Sharp, 197
 Souttar, H. S., 50, 142
 Spencer, W. G., 247
 Stanley, 165
 Stein, 221, 224
 Stern, 156
 Stonham, C., 177
 Streubel, 227
 Sutton, Sir J. Bland, 3, 27

 Tesson, 224
 Thomson and Miles, 145, 160
 Tillaux, Prof., 30, 94, 114, 116, 193
 Tischendorf, 187
 Travers, B., 22
 Treves, Sir F., 210, 257
 Tuffier, Prof., 197
 Turgis, 178

 Velpeau, 154
 Verdier, 197

 Warbasse, J. P., 134, 161
 Waring, H. J., 30, 71, 134
 Warren, R., 163, 243, 245
 Warren Low, 157
 Wassilieff, 171
 Weir, 184
 Whiteford Hamilton, 251
 Wiel, Van de, 199
 Wishart, 205
 Wölfler, 184
 Wood, Prof. John, 11, 34, 47, 50, 148
 Wrisberg, 91

INDEX OF SUBJECTS

- Absence of sac, occasional, in cases of hernia, 16, 135
- After-treatment of operation cases, 78, 251 *et seq.*
- Anæsthetics in operating for hernia, 36, 40-45, 234

- Bacillus coli, important action of in strangulated hernia, 217
- Bilocular hernial sacs, in women, 112; in men, 113-118
- Bladder, the urinary, hernia of, 66, 197 *et seq.*
 - calculi formed in herniated diverticulum, 199
 - danger of torsion of sac in hernia of, 198
 - uncovered diverticulum of, in femoral hernia, 159
 - pathology of hernia of, 197
 - relation to femoral hernia, 159
 - wound of during operations, 67, 198
- Caecum in left inguinal hernia, 196
- Canal of Nuck, relation to hernia and cysts, 108, 109
- Cancerous nodules in hernial sacs, 13, 134
- Congenital hernia, inguinal, 5, 8 *et seq.*, 89-103
 - intra-abdominal, 7
 - umbilical, 7, 118-121
- Conjoined muscles in relation to hernia, 28, 58, 70; 162
- Constipation in hernial cases, 33, 79, 220
- Cysts in wall of hernial sac, 67

- Direct inguinal hernia, anatomy of, 103
 - causation and frequency, 104
 - treatment of, 106
- Drainage of intestine, question of in strangulated hernia, 245, 251
- Ectopia testis in relation to hernia, 94 *et seq.*
- Fallopian tube in hernial sac, 176
- False reduction of a hernia by taxis, 227-234
- Femoral hernia, 143-164
 - anatomy of, 144-154
 - causation and relative frequency, 143
 - congenital, possible origin, 156
 - diagnosis of, 156
 - double sac in, 155
 - narrowing the ring, 160
 - operation for radical cure, 157-164
 - operation for strangulated, 238
 - strangulated in women, frequency of, 144
 - treatment of sac in, 159
 - use of conjoined tendon in operation on, 162
 - varieties, rare, 154
 - vessels, relation to, 150
 - young subjects, in, 156
- Filigree, use of silver in hernia operations, 51, 85, 131
- Floating kidney in an inguinal hernia, 110
- Foreign bodies in hernial sacs, 12
- Gangrene of intestine in strangulated hernia, 216
- Gubernaculum testis, 90 *et seq.*

- Haemophilia, relation to hernia operations, 36
- Heredity, influence of with regard to hernia, 3

Hernia, abdominal symptoms due to presence of, 32
 age-limit, question of, for operations on, 36, 39
 appendix epiploica (inflamed) in sac, 189
 causes of, 2 *et seq.*
 comparative frequency in the two sexes, 2
 congenital inguinal, 7, 8, 89-103
 constipation in relation to, 33, 79
 contra-indications to operation for radical cure, 39
 diaphragmatic, 171
 difficulties in detection of, 7
 direct inguinal, 103-107
 fatty, 9, 18-24, 211
 femoral, 142-164
 "giant," 175
 heredity, influence in production of, 3
 hydrocele of the sac, 13-15, 147
 infantile, 11
 in infants and children, operation on, 38
 inflamed or suppurating, 203
 indirect inguinal, 25 *et seq.*
 influence of occupation in producing, 4
 inguinal in women, 107-111
 in lower animals, 3
 lumbar, 170
 Meckel's diverticulum in, 189
 multiple, 9
 obstructed and incarcerated, 123, 202
 obturator, 164-170
 ovary and Fallopian tube, 176 *et seq.*
 para-vesical, 74, 169, 171
 perforation of intestine in, 12, 242
 precautions before operation for radical cure, 34-36
 preliminary examination of cases, 34
 recurrent after operation, question of further treatment, 38
 relative frequency of the different forms, 1
 resection of intestine during operation on, 48, 75, 243-251
 Richter's, 157, 208
 sciatic, 171
 seasonal effect on, 34
 stomach in inguinal sac, etc., 174
 strangulation of, 207-258

Hernia—*contd.*

testis, imperfect descent of, in relation to, 89-100
 translucency, occasional, 32
 trusses, use of, for, 34, 38, 79, 81, 152, 161
 umbilical, 118-134
 ventral, 1, 134-142
 vermiform appendix, 179-187
 women, in, operation for radical cure, 74
 Hydrocele from pressure of truss, etc., 15
 following radical cure operations, 84
 of hernial sac, 13, 147
 of cord coincident with hernia, 16
 "Incarcerated" or obstructed hernia, 122, 205
 Incidence of strangulation at different ages and in the two sexes, 214
 Indirect inguinal hernia, anatomy of, 25-30
 contents, varying of, 64
 diagnosis, 30-32
 methods of radical cure, 52-88
 operation on strangulated, 234
 results of operations, 80-84
 Interstitial or intermuscular hernia, 113-118
 in women, 112
 Lipomata in hernial regions, 22, 23
 Meckel's diverticulum in hernia, 189
 Obturator artery, the abnormal, in relation to hernia, 153
 Obturator hernia, 164-170
 contents of sac, 166
 diagnosis of, 166-168
 operations for, 168
 pathology, 165
 rarity of, 165
 Omentum, diagnosis of, in a hernia, 31
 treatment of, during operation, 64, 237
 Ovary and Fallopian tube in hernia, 110, 167, 176
 congenital band between it and appendix, 195
 in obturator hernia, 167

- Overlapping method in radical cure, 127, 140, 141
- Phimosis as a possible cause of hernia, 4
- Radical cure of hernia, femoral, 157-164
 inguinal, 52-88, 98, 102, 106, 111, 116
 umbilical, 123-134
 ventral, 138-142
 after - treatment of operation cases, 78
 buried sutures in, choice of, 46-51
 complications (occasional) following, 84
 selection of cases for, 34-39
- Reduction, false of a hernia by taxis, pathology, etc., 227
 treatment, 232
- Resection of intestine for gangrene 243-250
- Richter's hernia, femoral, 157, obturator, 166
- Sac, the hernial, 7 *et seq.*
 absence of, 16, 135
 bladder forming part of, 66, 197, 201
 cancer of, 13, 134
 contents met with in operations, 64-67
 cyst in wall of, 67
 double or bilocular, 10, 11, 112, 113-118, 146, 227
 foreign bodies in, 12
 hydrocele of, 13, 146, 147
 interstitial or interparietal, 113-118
 methods of dealing with, 57, 60-64 (femoral), 159
 mobile or retractile, 9, 227
 partial deficiency in "sliding hernia," 17, 65, 66
 torsion of, in the radical operation, 61-64
 treatment of, in strangulated cases, 235
 tubercle of, 12, 134
- Sigmoid colon, hernia of, 17
- Silk as buried suture in hernia operations, 47, 142
- Silver wire or filigree in hernia operations, 51, 85
- Sliding hernia of caecum or sigmoid colon, 17, 65, 66
- Spinal analgesia during hernia operations, 42, 45
- Spleen, congenital band connecting with testis in an inguinal hernia, 93
- Staple method in femoral hernia operation, 145, 152
- Stomach, importance of washing out in cases of strangulation, 234, 238
- Stomach, hernia of, 174
- Strangulated hernia, 202-258
 after - treatment of operation cases, 251
 bacillary action in, effects of, 217
 children, in, 214, 224
 complications following operation on, 254
 constipation of no value as sign of, 220
 difficulties in diagnosis, 222 *et seq.*
 false reduction of, 227-234
 gangrene of intestine in, 216
 gradual onset of symptoms, occasional, 210
 incidence, age, and sex, 214
 inflammation of sac, etc., simulating, 202
 mechanism and effects, 211 *et seq.*
 mortality following operations for, 256
 operations on, 234-251
 repeated slight attacks of, 210
 spontaneous recovery possible, 210
 symptoms associated with, 219 *et seq.*
 taxis in, dangers of, 226
- Taxis, question of use in hernia, 148, 202, 227
- Testis, band uniting it with spleen, 93
 descent of, in relation to hernia, 89-100
 ectopia of, 94 *et seq.*
 hernia with retained, operation on, 97
 in Scarpa's triangle and femoral canal, 91
 relation of to interstitial hernia, 113
- Testicular complications after operation, 84

- Thrombosis of veins following radical cure, 87
- Umbilical hernia, 118-134
in adults, difficulty in dealing with, 122
incarceration or obstruction of contents, 122
radical cure of, 123-134
strangulated, 240
- Uterus, in sac of obturator hernia, 167
- Varicocele in relation to inguinal hernia, 35
- Varicose veins with hernia, 9
- Vas deferens, risk of division in operations on children, 84
- Ventral hernia, causes of, 135
operative treatment of, 138
pathology, 136
- Vermiform appendix, hernia of, 179-197
and caecum in left inguinal hernia, 196
connection with undescended testis, 192
in hernia, diagnosis of, 185;
inflammation of, 180; resemblance to Fallopian tube, 186; theory of production of, 182; treatment, 189

THE END



**University of Toronto
Library**

**DO NOT
REMOVE
THE
CARD
FROM
THIS
POCKET**

Acme Library Card Pocket
Under Pat "Ref. Index File"
Made by **LIBRARY BUREAU**

